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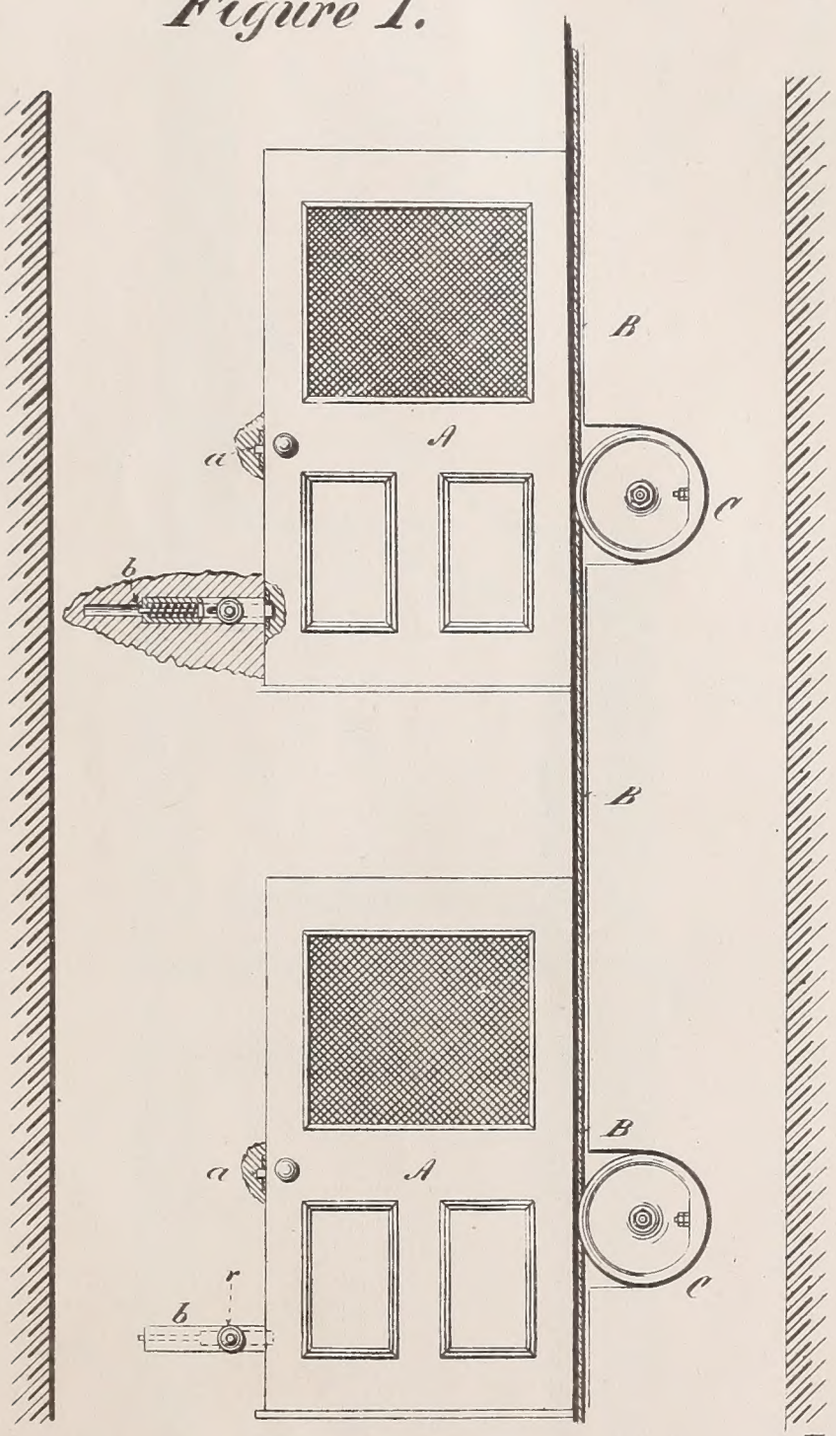
3 Sheets—Sheet 1.

E. N. DICKERSON.

Operating Hatchway-Doors.

No. 223,322. Patented Jan. 6, 1880.

Figure 1.



Witnesses:
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A. Brief Jr.

Inventor:
E. N. Dickerson
By his Attorney
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

223322

3 Sheets—Sheet 2.

E. N. DICKERSON.

Operating Hatchway-Doors.

No. 223,322. Patented Jan. 6, 1880.

Figure 2.

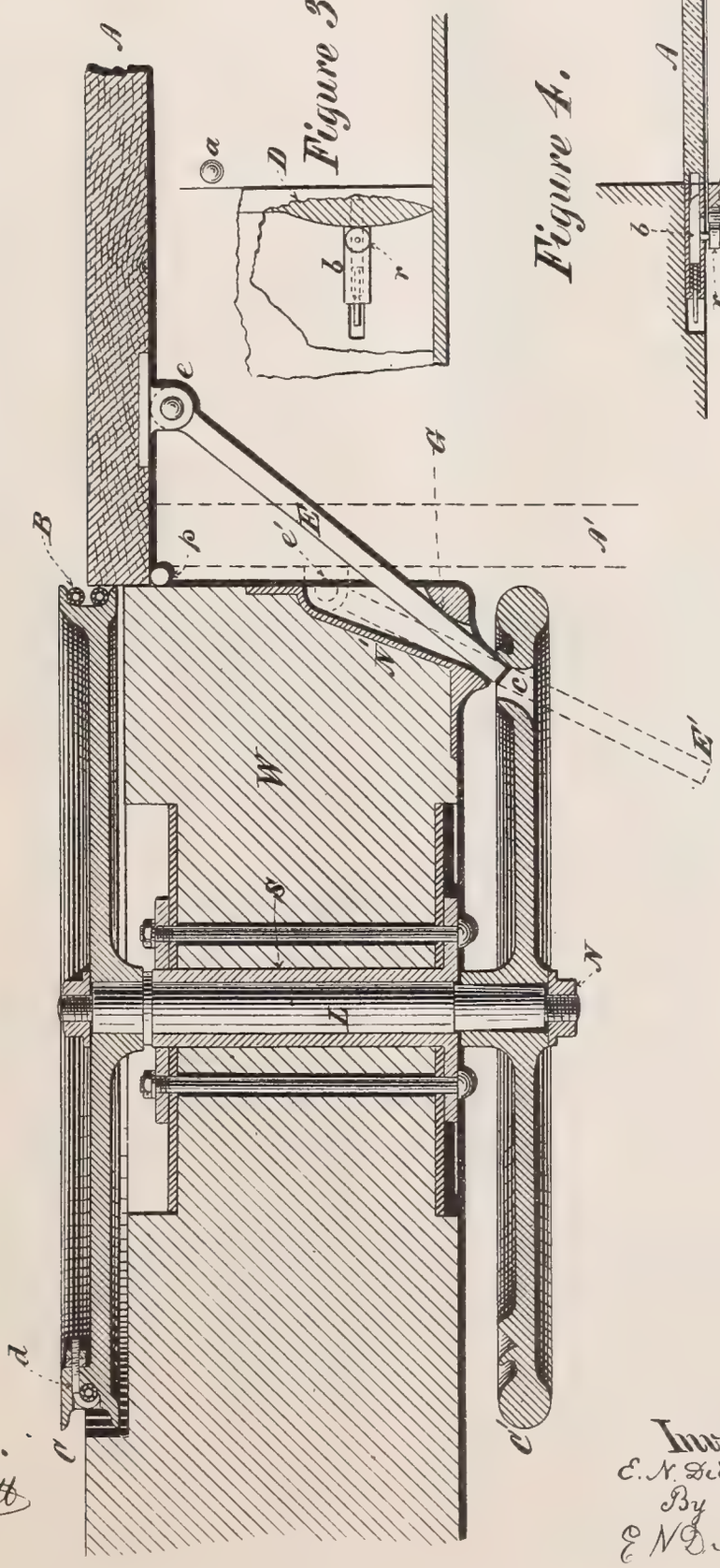
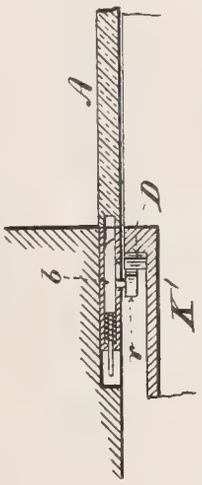


Figure 3.

Figure 4.



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3 Sheets—Sheet 3.

E. N. DICKERSON.

Operating Hatchway-Doors.

No. 223,322. Patented Jan. 6, 1880.

Figure 5.

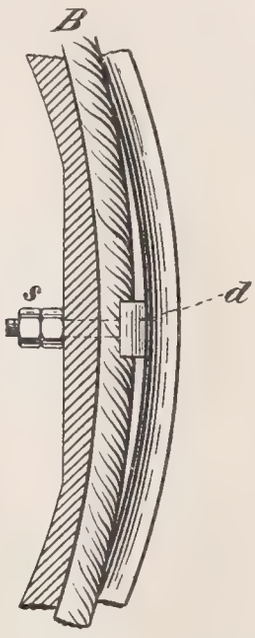
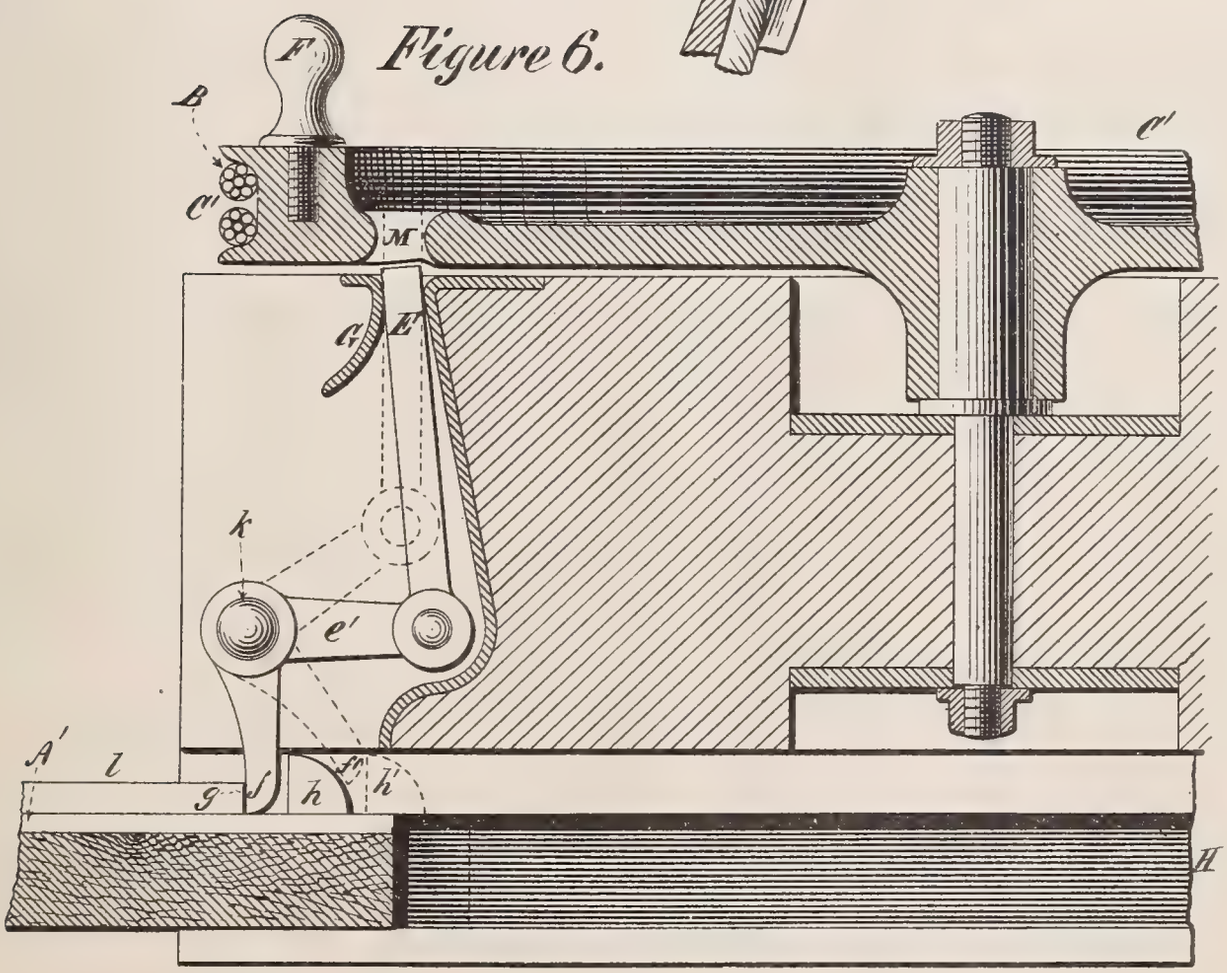


Figure 6.



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Inventor:

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By his Attorney

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THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

EDWARD N. DICKERSON, OF NEW YORK, N. Y.

OPERATING HATCHWAY-DOORS.

SPECIFICATION forming part of Letters Patent No. 223,322, dated January 6, 1880.

Application filed October 13, 1879.

To all whom it may concern:

Be it known that I, EDWARD N. DICKERSON, of the city, county, and State of New York, have invented a new and useful Improvement in Elevators, of which the following is a full, true, and exact description, reference being had to the accompanying drawings.

The object of my invention is to so connect the elevator, elevator-starting mechanism, and the doors opening into the elevator-wellway that an attendant in the elevator may be dispensed with and the elevator can be brought to any of the floors that may be desired, while at the same time a passenger using the elevator runs no risk of injury, either from falling down the wellway or from being injured by the movement of the elevator while entering or leaving the car.

In order to successfully accomplish these results it is necessary to provide at every floor an elevator-controlling mechanism, by means of which the car can be brought to that floor when desired. It is also necessary that every door in the series be locked from within, excepting when the elevator is in position to receive a party desiring to enter it, and, also, that when the elevator is at rest at any floor and the door is open, the starting mechanism be then locked, so as to prevent the movement of the elevator until after the door is closed and the passenger has passed into the elevator.

My invention will be clearly understood from the accompanying drawings, in which—

Figure 1 represents an inside view of the elevator-wellway, showing the starting-wheels and locking mechanism. Fig. 2 is a horizontal sectional view of one of the starting-rope connections and of one of the elevator-doors. Fig. 3 is a detailed view of my mechanism for unlocking the door of the passage to the elevator. Fig. 4 is a sectional view of the same. Fig. 5 shows a means for adjusting the starting-rope on the starting-wheel, and Fig. 6 is a detailed view of a modification of my apparatus employed when a sliding instead of a swinging door is used.

A, Fig. 1, represents the inner view of the doors opening into the passage-way from the elevator. These doors may be either swinging or sliding, as shown in Fig. 6. They are, of course, arranged, when swinging, to open outward into the hallway.

The elevator-car (not shown) is operated in any of the well-known ways, and is controlled by a starting-rope, B, which passes up inside of the wellway and around a series of wheels, C, one at each floor. It also passes around idler-wheels and through the elevator-car, in the usual way.

The elevator-doors are provided with two latches—one, *a*, controllable from either side of the door; the other, *b*, which consists of a spring-latch, withdrawn by a roller, *r*. This roller is tripped by a cam connected with the elevator, as shown in Figs. 3 and 4.

In Fig. 4, K′ represents a portion of the elevator-car provided with cam D. This cam is shown acting against the roller *r*, and in the act of withdrawing the bolt *b*. This cam is so arranged on the elevator with reference to the automatic latches *b* that it will withdraw those latches when the door of the elevator-car is opposite the door entering into the wellway.

It will thus be observed that no door can be opened excepting when the elevator is opposite. The cam D is made sufficiently long to allow of a reasonable variation in the position of stopping the elevator.

The latch *a* is not absolutely essential, but is convenient to prevent the accidental opening of the door, excepting when it is opened by a passenger. Doors A should be preferably provided with automatic springs for closing them, and each door is provided with the mechanism shown clearly in Fig. 2.

The elevator starting-rope is shown at B. Two wheels are provided—the inner one for receiving the starting-rope, the outer one, C′, for the hand-wheel. These wheels should be strongly made, and should be supported by a sleeve similar to the one shown at S, or in some other convenient way. The wheels C and C′ are, of course, firmly attached to the same spindle L. The wheel C′ is made adjustable on said spindle by means of the nut N and the conical taper on the end of the spindle in a manner well known to mechanics; or any other convenient mode of adjusting might be used. This wheel is provided at one place with a slot, *c*.

The door A, pivoted at *p*, is provided with a bolt, E, pivoted to the door at *e*. The wall W between the elevator-well and the passage-way is provided with a casting, N′, for supporting and guiding the bolt E. The wheel C′ and the bolt E are so arranged that when the door is closed the bolt E is withdrawn from the wheel; but when the door is open it is shot through the wheel, and the bolt will then be in the position shown at E′ in dotted lines, and the door in the position shown at A′. When the door and bolt are in the position shown by the dotted lines it is plain that the wheel C′ cannot be revolved, and, of course, the locking of any wheel of the series locks every other wheel, since the starting-rope B passes continuously around all of them. The ordinary arrangement of the starting-rope allows said rope to be in three positions—either in a central position, or above or below it.

The wheels shown are so adjusted that when the starting-rope is in the central position and the elevator at rest the slot *c* will be exactly opposite the ends of the bolt E, which is supported by the casting N; but if any one of the wheels be revolved, then the slot *c* will be out of correspondence with the bolts, and consequently no door can be opened, because the bolts E would bring up against the solid part of the wheel C′. A means of adjustment between the wheel and the starting-rope is shown at Figs. 2 and 5, where the starting-rope is fastened to the starting-wheel C by means of a hook-clamp, *d*. By loosening the set-screw *s* the relation between the wheel and the starting-rope can be altered.

The principle of my improvement can now be understood. The wheels having been properly adjusted so that when the slot is in the central position and the elevator at rest their slots correspond to the bolts E. Suppose a passenger to open the door opposite which the elevator is at rest. The opening of this door would immediately lock the starting mechanism, and the elevator cannot be moved until the door is closed. By this means all danger is avoided from any passenger starting the elevator on any floor while the first passenger is entering. After closing the door the passenger in the elevator starts the car by pulling the rope which passes through said car. As soon as the elevator has begun to move, every door is locked in two ways—first, by the automatic bolts *b*, which are successively tripped as the elevator passes the doors, and, secondly, because the bolts E do not correspond to the slots *c* in the hand-wheel C′, so that if a passenger on the second or any other floor should endeavor to enter the elevator while it was passing, at the instant when the elevator tripped the bolt E, he would still be prevented, because of the relation between the wheel C′ and the bolt E. When the passenger within the elevator has arrived at the desired story he stops the car in the usual way. In so doing he revolves all the wheels, so as to bring the slot *c* in correspondence with the bolt E, and at the same time the bolt *b* on the door opposite which the elevator is stopped is tripped, and he is thereby enabled to open the door and pass into the passage. Whenever all the doors are closed and the car at rest, a passenger on any story can readily bring the car to that story by simply turning one of the hand-wheels C′.

The position of the slot *c* with reference to the bolt E will indicate to any passenger on any floor whether the elevator is in use or not, and also whether the elevator is ascending or descending. In this way there will be no danger of interference with the elevator while in motion by any passenger desiring to use it. Of course, different means of adjusting the position of the slot with reference to the bolt could be employed—as, for instance, a slot might be cut in an independent wheel attached to the hand-wheel C′, and their relation be regulated by set-screws moving in slots. It is also evident that a sliding bar forming a part of the rope-connection and movable up and down by hand outside in the passage-way, and having a slot in it for the entrance of the bolt when the door was opened, could be substituted for the slotted wheel, and many other modifications might be made; but they would be all operated in the same way and be substantially the same as the form shown, because in all of them the starting mechanism would be locked by the opening of the door and unlocked by its closing.

Fig. 6 represents a modification of my apparatus.

The doors opening into the elevator-wells are of two descriptions—either swinging, as in Fig. 2, or sliding, as in Fig. 6. It is as important that the opening of the sliding door shall automatically lock the starting mechanism as it is that the swinging door should have that effect. The mechanism shown in Fig. 6 is in principle the same. It will be observed that the hand-wheel and the sheave for the rope are combined in one. In this case the starting-rope passes around the periphery of the hand-wheel C′ in an annular channel. This wheel is also provided with a handle, F, for convenience, and is also provided with the perforation M. (Found in Fig. 2 of the drawings.)

Set in the wall is the bolt E, which rests in the casing G, preferably metallic, and made sufficiently strong to support and guide the bolt E. This bolt is drawn in and out by means of the bell-crank *e′ f*, pivoted at *k*. The bolt E is attached to the arm *e′*. The sliding door is represented at A′ and moves in the slideway H. This door is provided with a surface, (preferably metallic,) *l*, having a jog or corner at *g*. There is also a quadrant-shaped lug, *h*, which is so arranged in connection with the jog or corner *g* that the arm *f* of the bell-crank will pass into the opening or space between *g* and *h*, as shown in full lines in the figure. The arm *f*, as will readily be seen, is provided with two sides, one straight and the other curved. The straight side or face engages with

the corner *g* and is operated by it, and the curved side is acted against by the straight side of the quadrant-lug *h*. These operations may be seen in the dotted lines.

Supposing the hand starting-wheel C′ to be in the position shown in Fig. 6, so that the slot or opening M corresponds with the bolt E, and supposing the sliding door A′, the bolt *b* of which has been tripped by the elevator, to be opened, the first result would be that the bell-crank *e′ f* would be swung about on the pivot *k* into the position shown in the dotted lines. This is accomplished by the action of the corner *g* against the arm *f* of the bell-crank. This movement, of course, throws the bolt E through the slot or opening M, and the bolt remains in this position until it is returned by the shutting of the door. This is accomplished by the engagement of the straight side of the quadrant-lug *h* against the curved side of the arm *f*, as shown at *f′ h′*. This movement will return the bolt into the position shown in the solid lines. Of course, where a sliding door is used a bolt, *b*, suitable for locking such door, should be employed. This can be readily supplied, and it should be tripped in the same way by the cam on the elevator.

When the elevator is in position the starting-rope passes over two wheels—one at the bottom and the other at the top of the wellway. One part of this rope passes through the elevator in the usual way, and is controlled by mechanism in said elevator. The other part passes around the starting-sheave heretofore described. Now, it is evidently necessary that the starting-wheels be so exactly adjusted with reference to this rope that when the elevator is at rest and the slot *c* in the neutral position the slots in the wheel shall correspond with the bolts, and it is also evident that any lengthening or stretching of the starting-rope will also throw these slots out of their correspondence with the bolts.

The starting-wheels, spindles, bolts, and other parts of the mechanism should be made sufficiently strong to be able to resist any strain thrown upon them by an attempt to open the door under conditions in which the slot in the wheel and the bolt are not in correspondence.

The hand-bolt *a* and the automatic bolt *b* might be combined in one by an arrangement which would prevent the withdrawal of a bolt, *a*, excepting when the elevator was opposite.

By means of this apparatus perfect safety in the use of passenger-elevators is obtained, because no one can be injured by entering the elevator-well when the elevator is not opposite the door; and, secondly, no one can be injured by the starting of the elevator at the same time that he is attempting to enter the car.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with the wellway-door of an elevator, of a locking mechanism acting in combination with the starting mechanism of the elevator, whereby the open door prevents the movement of the elevator until said door has been closed, substantially as described.

2. An elevator wellway-door provided with mechanism which acts, in connection with the elevator-starting mechanism, to prevent the movement of the elevator on the opening of a door, and which also prevents the opening of the door excepting when the elevator is stationary, substantially as described.

3. The combination, with an elevator and its wellway-door, of two latches, one of which is automatically tripped by the elevator, the other of which is operated by the passenger, substantially as described.

4. The combination of an elevator wellway-door, elevator-starting mechanism, and a bolt connected with said door and constructed to pass through and engage with the elevator-starting mechanism, whereby the movement of the door automatically locks said starting mechanism, substantially as described.

5. In combination with an elevator and wellway, a series of wheels, one arranged at each stopping-place of the elevator and connected with the elevator-starting mechanism, each wheel being provided with a slot and a locking-bolt connected with the wellway-door, and passing through it at a definite position of the wheel, substantially as described.

6. The combination, with a wellway-door, of an elevator-starting wheel and a bolt connected with said door, and so combined with the elevator-starting wheel as to pass through a slot in the same when the elevator is at rest, substantially as described.

EDW. N. DICKERSON.

Witnesses:
S. F. SULLIVAN,
A. POLLOK.

(No Model.) 3 Sheets—Sheet 1.

W. F. SEXTON, Sr. & W. F. SEXTON, Jr.

HOIST.

No. 254,242. Patented Feb. 28, 1882.

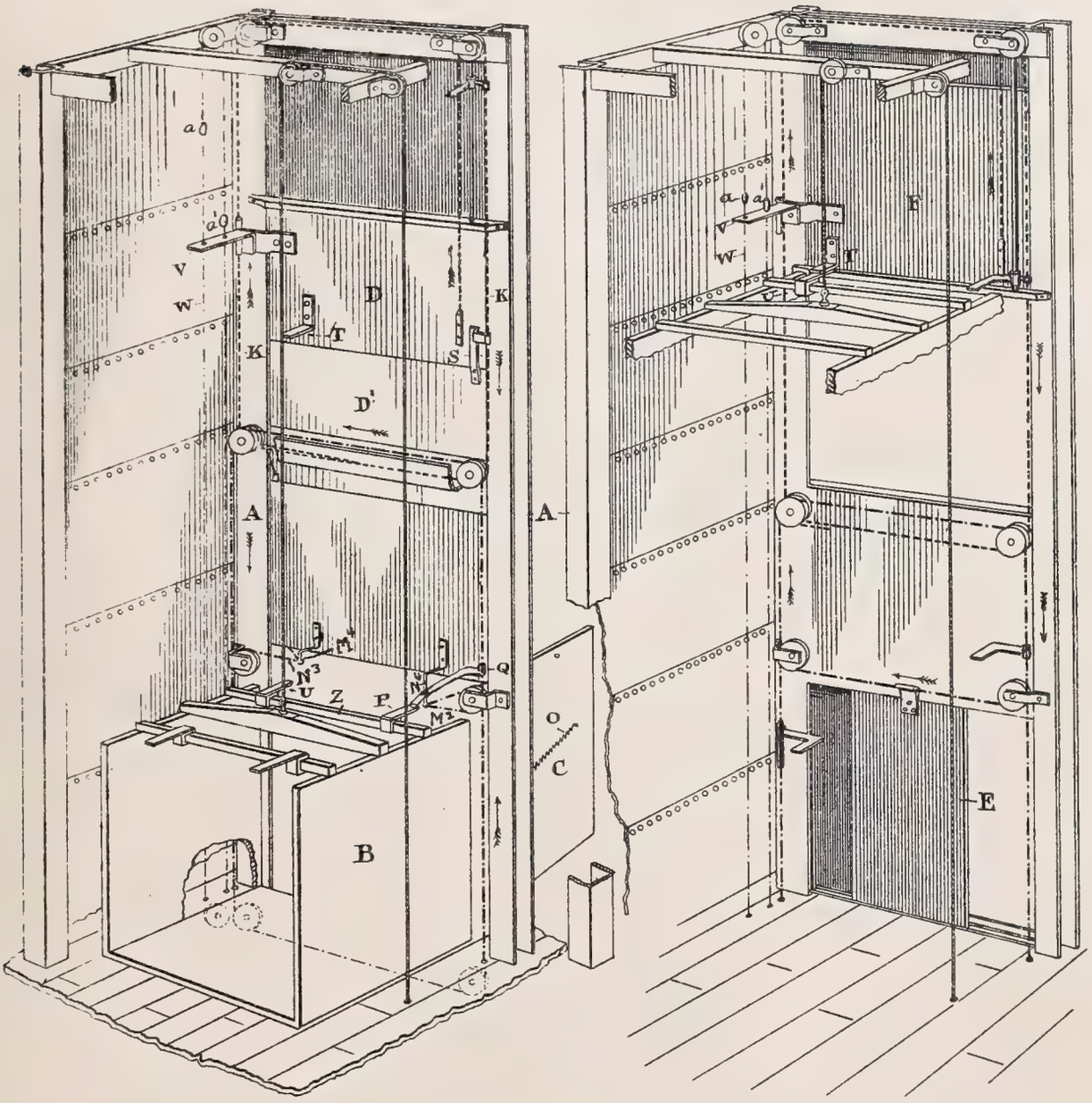

Fig. 1. *Fig. 2*

Witnesses.

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C. W. Baldwin

Inventors.

W. F. Sexton Sr

W. F. Sexton Jr

by Ridout Ardrobbo

Attys.

(No Model.) 3 Sheets—Sheet 2.

W. F. SEXTON, Sr. & W. F. SEXTON, Jr.

HOIST.

No. 254,242. Patented Feb. 28, 1882.

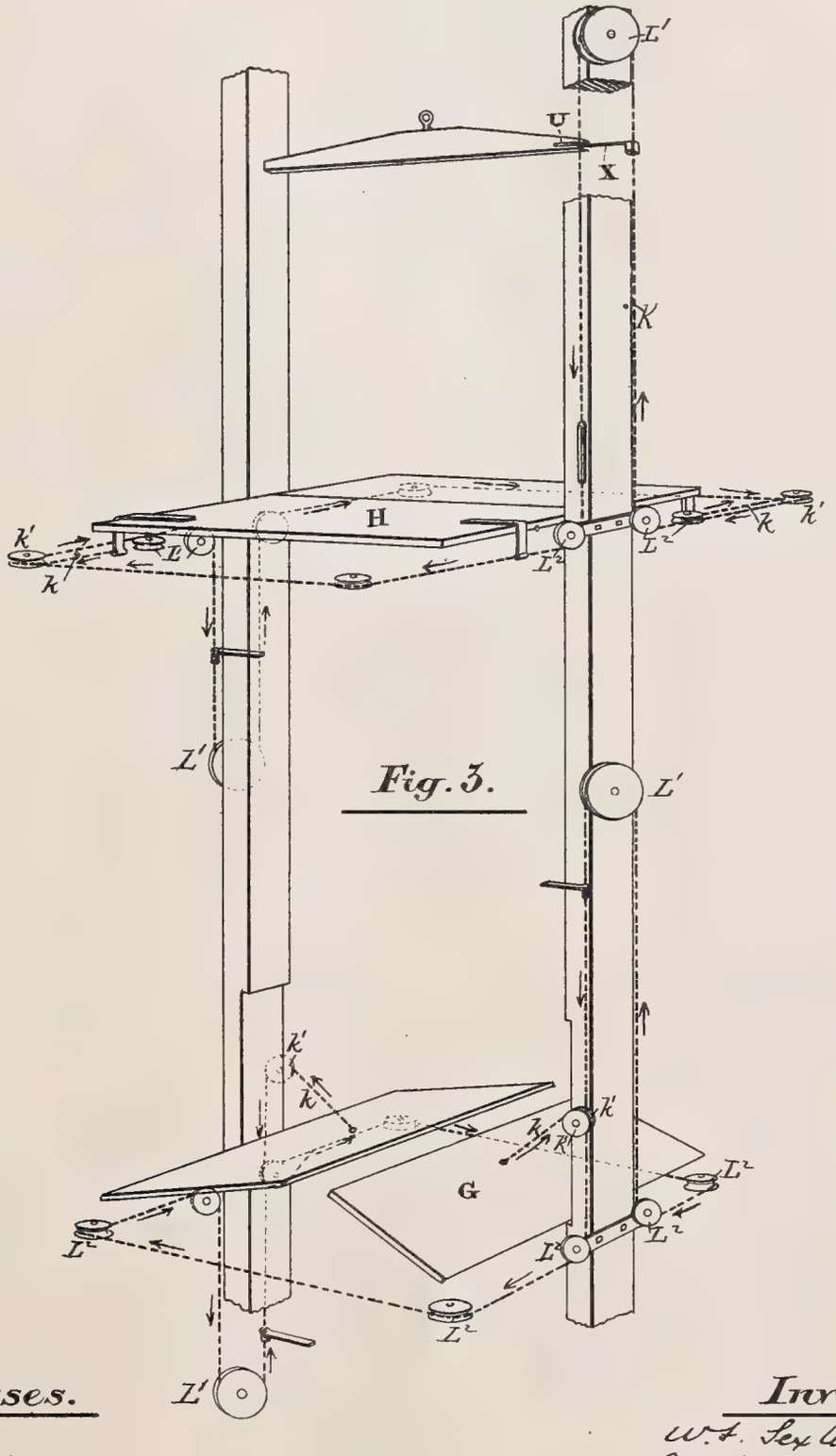

Fig. 3.

Witnesses.

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W. F. Sexton Jr

by Ridout Ridouts

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(No Model.) 3 Sheets—Sheet 3.

W. F. SEXTON, Sr. & W. F. SEXTON, Jr.

HOIST.

No. 254,242. Patented Feb. 28, 1882.

Fig. 4.

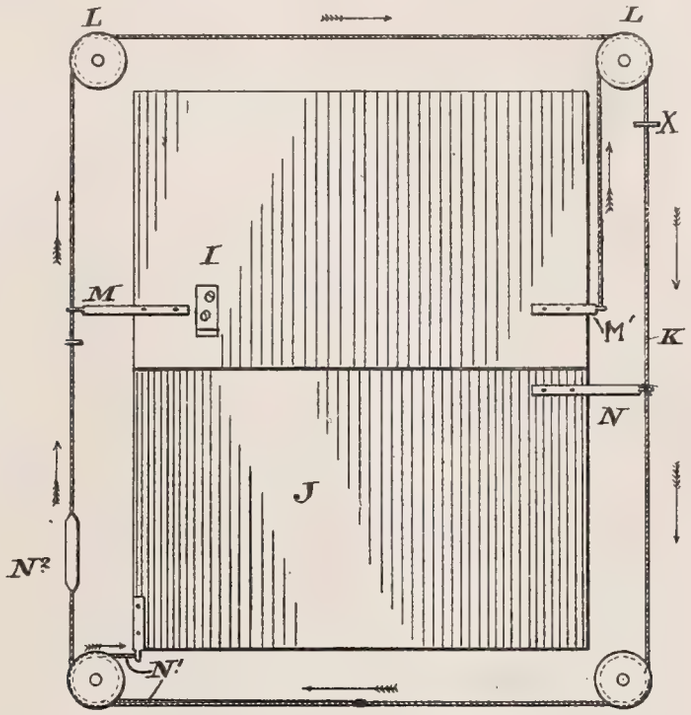
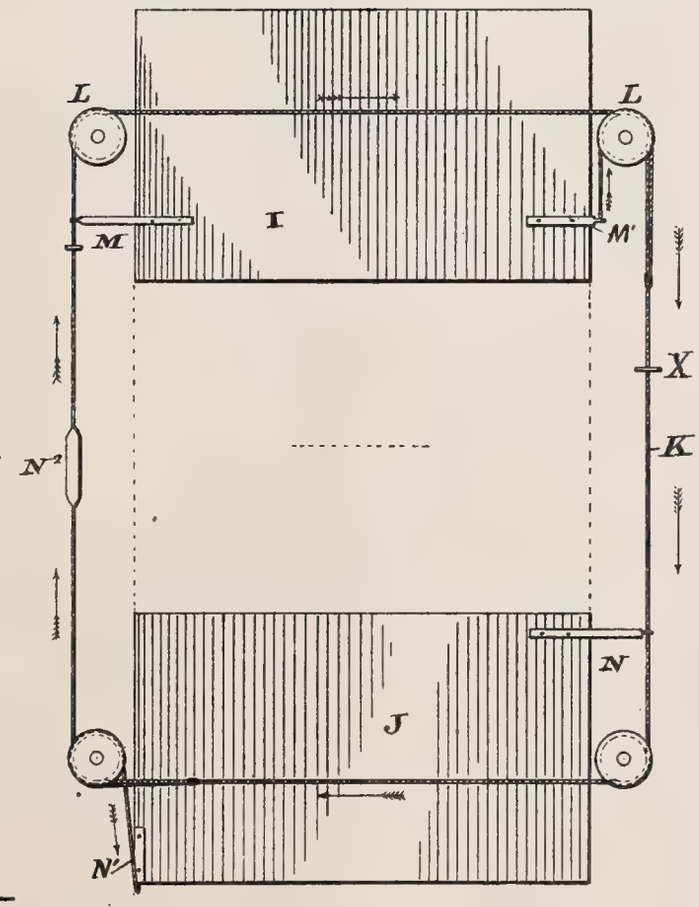


Fig. 5.



Witnesses.

Lewis Tomlinson

C. W. Baldwin

Inventors.

W. F. Sexton Sr.
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by Ridout & Birdsall
Attys

UNITED STATES PATENT OFFICE.

WILLIAM F. SEXTON, SR., AND WILLIAM F. SEXTON, JR., OF TORONTO, ONTARIO, CANADA.

HOIST.

SPECIFICATION forming part of Letters Patent No. 254,242, dated February 28, 1882.

Application filed April 25, 1881. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM FRANCIS SEXTON, Sr., and WILLIAM FRANCIS SEXTON, Jr., both of the city of Toronto, in the county of York, in the Province of Ontario, Canada, have invented new and useful Improvements in Hoists, of which the following is a specification.

The object of the invention is to provide automatic machinery by which the doors of hoists or elevators are opened by the movement of the car or cage; and it consists essentially of an endless cord or band connected to the door, in combination with a lifting pawl adjustably attached to the car or cage, and so arranged that it can be set to come in contact with a bracket preferably placed upon the doors of the hoist, substantially as hereinafter explained.

In the drawings, Figure 1 is a perspective view of a hoist in which the lower doors are made to swing outwardly. The upper door is designed to open in two parts, one half ascending while the other half descends. Fig. 2 is a similar view of a hoist in which the lower door slides sidewise and the upper door rises. Fig. 3 is a perspective view of a goods-hoist, the lower door arranged to swing upwardly, while the upper door is arranged to slide horizontally.

A are the standards or guides of the hoist. B is a cage; C, the lower door in Fig. 1, hinged to swing outwardly. D is the upper half and D′ the lower half of the upper door in this figure. E is a lower door in Fig. 2, arranged to slide sidewise, and F is the upper door, arranged to slide vertically. G are hinged floor-doors in Fig. 3, and H the sliding floor-doors in the same figure.

As all the doors, no matter in what way they are arranged to open, are operated on the same principle—viz., by the application of an endless rope connected to them, and through which the desired motion is secured by the movement of the cage—it is therefore well, before explaining in detail the operation of the doors illustrated, to explain briefly the principle upon which they are operated. With that view we show in Fig. 4 a skeleton view of our endless operating-cord, the effective working of which may be explained in a few words.

I and J represent respectively two sliding doors, the upper, I, being arranged to slide upwardly, while the lower, J, is caused to descend.

K is an endless rope or cord passing around four pulleys marked L. These pulleys are pivoted on the standards or other suitable point in the hoist, independent of the doors.

M is a bar connecting one side of the door I to the rope K, and M′ is a bar connecting the rope K to the door I through the medium of a branch rope passing over the pulley L and connecting with the rope K on the opposite side, and the bar N and cord N′ similarly connect the door J to the same rope, K, on opposite sides thereof, as represented. In order, then, to operate these doors, it is only necessary to apply power to the endless rope K in such a manner as to cause it to travel. This may be effected by arranging a suitable projection on the cage to come in contact with a bracket placed on the door I, or, as indicated in the drawings, a catch or projection on the rope K. By thus moving the rope K in the direction indicated by arrows the upper door, I, will be caused to ascend while the lower door, J, will be caused to descend, the doors and connections specified assuming the position shown in Fig. 5.

It will be well, as we are now referring to Figs. 4 and 5, to draw attention to the fact that owing to the connection between the endless rope K and doors I and J it will be possible, by making the upper door heavier than the lower door, J, to cause it to counterbalance and lift the lower door when relieved from the cage; or a counter-balance, N^2, may be placed on one side of the rope K, being sufficiently heavy to counterbalance and raise the lower door, the upper one being closed by its own weight. It will further be noticed that the doors will rise evenly in their bearings, being connected on both sides to the endless rope K, which therefore exerts its power evenly. The effect of the movement of this endless rope will be the same when applied to any description of door, the connection to it being altered to suit the manner in which each particular door is hung. For instance, in Fig. 1 the lower door is shown to open outwardly, being caused to fly open by the action of a spring, O, the

endless rope in this instance being arranged to close the door when the cage B is caused to ascend, an arm, P, being placed upon this cage in such a position that it will come in contact with the catch Q, attached to the endless rope K. In this manner the rope is made to travel in the direction indicated by arrows and through the connection of the short branch cord M^2 and N^3, which pass from the endless rope and through the stationary brackets M^4 N^4 to the door C, as indicated, and close the doors, when they are locked by a suitable catch, which it is not here necessary to describe. The arm P is so arranged that it will keep in contact with the catch Q so long as it is necessary to close the door; but when the door is closed the pressure of the arm P becomes so great that the catch will bend the rope and allow the arm P to spring past said catch, after which the arm P will not interfere with the rope K again till set by sliding it on the bar Z of the cage to come in contact with another stop. The doors D and D′ in this same figure are connected to the rope K exactly in the same manner, as shown in Figs. 4 and 5. A projecting bracket, T, is attached to the upper door, D, and a lifting-bar, U, is suitably attached at a convenient point on one of the upper timbers of the cage. When the operator wishes to open the doors D and D′ he sets the lifting-bar U by sliding it on the bar Z of the cage, so that when the cage ascends it will come in contact with the bracket T, lifting the door D, and through it imparting a movement to the endless rope K, which, being connected, as described, to the door D′, causes the latter door to descend as the cage forces up the upper one.

We may here mention that in building a hoist the doors on the different flats of the building will preferably be of the same kind—that is to say, if the lower doors are of the kind indicated by C, then the upper doors of this particular hoist will be of a similar kind, and the arm P will be arranged to operate all the doors; or on the other hand, if the doors slide vertically, then each door is provided with a bracket, T, and the lifting-pawl U is so arranged that it may be set to operate any one of the doors desired.

As it is desirable that the water or other motor power should be closed off when the doors in any particular flat are opened, we provide a bracket, V, attached to the door D, through which the check-rope W passes, as indicated. Stops *a a′* are placed upon this rope W in such a position that when they are opposite to each other the power will be closed off. It will be seen from the drawings that the upward movement of the door D will, through the bracket V, carry the two stops opposite to each other, thereby effecting the desired end.

In Fig. 2 the top part of the cage is shown in an elevated position, the lifting-pawl U being in contact with a bracket, T, secured to the door, the bracket V being in the act of carrying the lower stop, *a′*, to a point parallel with the stop on the other side of the check-rope. By providing the door on each flat with a bracket for operating the check-rope, as described, the power, it will be seen, will be closed off when the door is opened, as represented in this Fig. 2, and so long as the cage remains in that position, with the door open, it is not possible for any one on a different flat to cause the elevator to move, and in this way accidents are avoided. When in this position, whenever it becomes necessary for the elevator to descend and the doors to close, the pawl U is moved from under the bracket T of the door, so as to enable the doors to be closed by moving the ropes K in the direction opposite to that indicated by the arrows in Fig. 1 and 2, and as soon as the bracket V has moved slightly below the stops *a a′* on the check-rope the check-rope can be operated for setting the operating machinery in motion. When the elevator or cage is at its highest point, as shown in Fig. 2, there is no necessity for closing the upper door, although it could be closed, if desired, for any reason, as above described, by sliding the pawl U from under the bracket T of the door.

On reference to Fig. 3 the manner of applying the endless rope K for the purpose of operating the sliding and hinged hatchway-doors is clearly shown, the main rope passing around pulleys L′ on opposite sides of the frame, and also around the guiding-pulleys L^2, and connected to the doors by branch ropes *k* passing over pulleys *k′*. In this case the lifting-pawl U is arranged to come in contact with the projecting arm X, attached to the endless rope K, as shown, which action causes the endless rope to travel, and owing to the manner in which it is connected to the doors they are caused either to fold or slide back, as the case may be.

In the drawings, in Figs. 1 and 2, we have shown a lifting-pawl provided with a square socket arranged to slide upon a cross-bar, Z. This may be done by hand, or, if found necessary, ratchet or other mechanism may be arranged for the purpose of adjusting it; or any other form of movable pawl or lifting-bar that will answer the desired purpose may be used; or a pawl may be pivoted to the cross-bar, so as to be adapted to turn to one side, as shown in Fig. 3.

In describing the action of the cage upon the lower doors, C, for the purpose of closing them we mention that a lifting pawl or bar comes in contact with a bracket upon the endless rope K. Instead of this plan, one equally as good would be to place a counterbalance-weight upon the endless rope sufficiently heavy to overcome the tension of the opening springs. In this case the doors would be opened by the movement of the cage, the power required being only that which would be sufficient to overcome the counterbalance-weight, as the moment the weighted rope was raised the springs would

throw the doors open. The lifting pawl or bar U should be so constructed that the one intended to open the door as the cage ascends should trip past the bracket when the cage is descending, and that pawl or bar made to open the door as the cage descends should be so constructed that it will trip past the bracket as the car ascends. Another important element consists in incasing the hoist with boiler-plate, forming a perfectly fire-proof escape. The doors being always closed, the upward draft is prevented.

It may be well to mention here that as each door is arranged to operate independently of all the other doors only one door will be open at a time, and that one opposite to the cage. It may further be stated that by setting the pawl to open a door in one of the upper flats the cage can be sent up empty, when it will automatically open the door for which it has been set, and owing to its connection with the check-rope the power will at the same time be shut off. In the case of hand-hoists which are operated by a brake the check-rope will be connected to and arranged to operate the brake instead of the power.

In order to announce the arrival of the cage at any particular flat, an attachment may be applied which will cause a bell to ring at the moment when the cage reaches the flat for which it has been set.

We are aware that it is not new to open and close the doors of the hatchways by means of ropes connected to drums which are operated by the movement of the elevator-cage, such invention forming the subject-matter of the patent of J. W. Kohl, dated December 2, 1879, No. 222,285; and therefore we do not broadly claim the use of ropes for automatically operating hatchway-doors by the movement of the elevator-cage.

What we claim as our invention is—

1. In a hoist provided with independently-acting doors, an endless rope or band provided with branch ropes or bands connected to the doors, in combination with a cage provided with movable arms and projecting catches or brackets on the endless rope or the doors, substantially as and for the purpose specified.

2. In a hoist, a sliding door provided with a projecting arm, in combination with stops on the check-rope, and the check-rope, whereby the motive power moving the cage is stopped by the opening of the door, substantially as specified.

3. In combination with an endless rope or band having branch ropes and catches or projections on the cage, and sliding doors or endless rope, as described, a projecting arm on one of the sliding doors and stops on the check-rope, substantially as and for the purpose specified.

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2 Sheets—Sheet 1.

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ELECTRICAL SAFETY DEVICE FOR ELEVATORS.

No. 10,838. Reissued May 31, 1887.

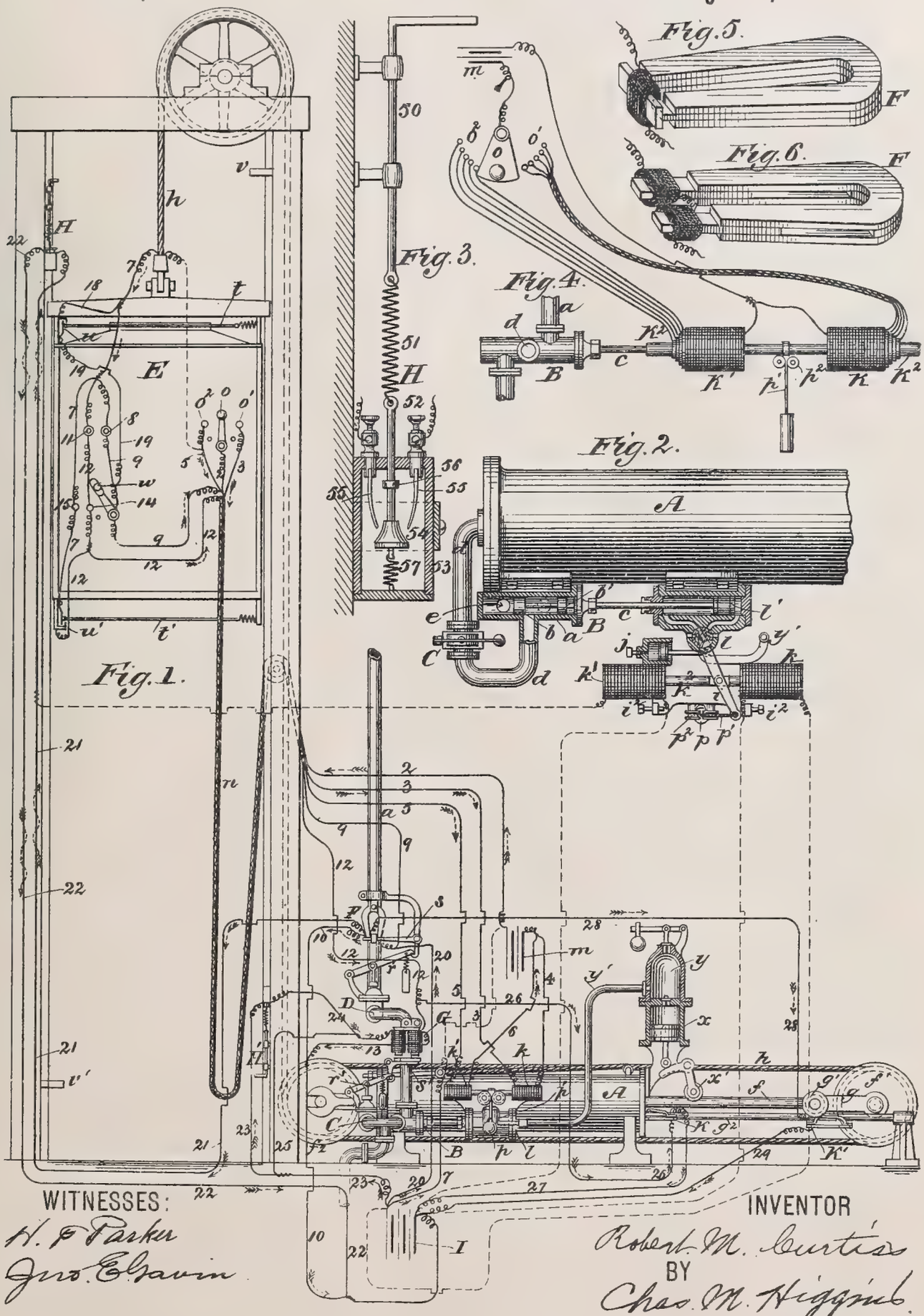

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

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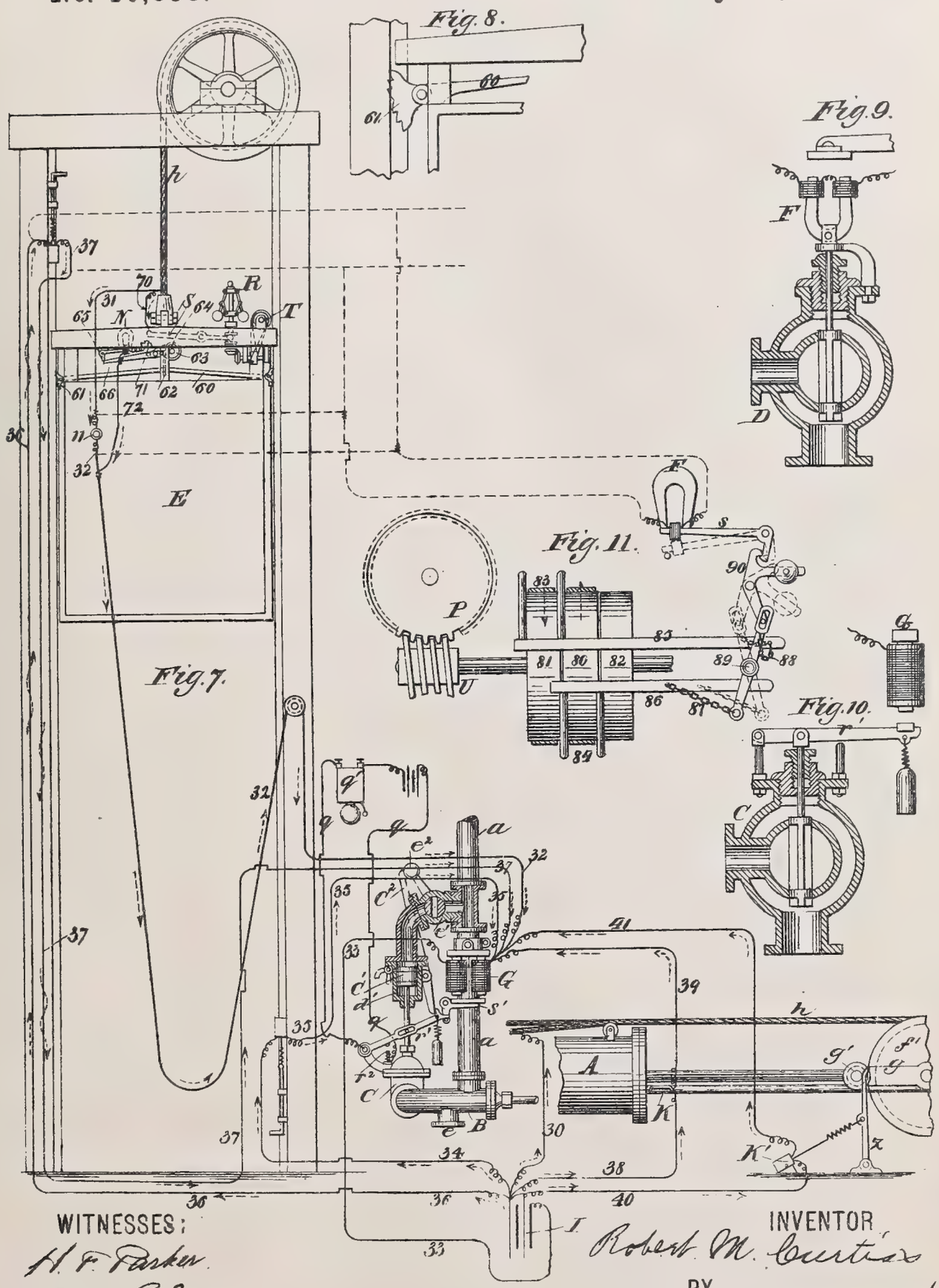

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ROBERT M. CURTISS, OF BROOKLYN, NEW YORK.

ELECTRICAL SAFETY DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Reissued Letters Patent No. 10,838, dated May 31, 1887.

Original No. 344,167, dated March 17, 1885. Application for reissue filed March 15, 1887. Serial No. 231,071.

To all whom it may concern:

Be it known that I, ROBERT M. CURTISS, of Brooklyn, Kings county, New York, have invented certain new and useful Improvements in Electrical Safety Devices for Elevators, of which the following is a specification.

My present invention aims to control the movements of the car and hoisting-engine by the agency of electricity governed by the operator in the car, and also automatically by the movements of the car itself, and it is partly related to those systems shown in my former patents, Nos. 216,024 and 266,107, and in my pending application, Serial No. 118,294, filed January 22, 1884, (on which a patent was granted August 18, 1885, No. 324,751.) My former inventions, however, chiefly concerned safety devices involving an electric circuit which traversed the cable, car, and hoisting machinery, so that in case of breakage of any part safety devices were released by the action of magnets to stop and sustain the car. In the latter application the collision of any object with guard bars on the shaft or car would automatically break an electric circuit and cause magnets to release a stop-valve or other stopping devices to stop the engine and car, and thus prevent the object from being crushed by the car. Besides this automatic means for stopping the car, a manual switch was placed in the car, whereby the circuit could be broken manually at any time to stop the car where desired, in case of accident.

In my former inventions it was assumed that the ordinary check-rope and mechanical devices for working the engine-valves from the car were employed; but in my present case I employ electro-magnets or their equivalents to actuate the engine-valves to cause the car to ascend, descend, or stop, which magnet is included in an electric circuit which is extended to the car and controlled by a switch in the car, thus enabling the movements of the car and engine to be controlled quickly and with great ease by the operator in the car, and obviating the objections which apply to the check-rope heretofore used.

In my former inventions no provision was made for automatically limiting the movement of the car and hoisting-engine at each end of the travel in case the check-rope broke or the stopping and starting valves of the engine became unmanageable. This is a contingency or accident which is very likely to occur with existing elevators, particularly those of the hydraulic kind, in which case the piston would tend to move out of the end of the cylinder and force the car beyond the top beams of the shaft, thus causing a general wreck, which many elevators in present use have no provision at all to guard against. In my present invention, however, I guard against this very probable and serious form of accident in a very simple and effective way by providing a special stop or safety-valve or its equivalent on the hoisting-engine, which is controlled by an electro-magnet or its equivalent in an electric circuit, which is completed through contacts at the top and bottom of the car or at the top and bottom of the shaft, and a projection is arranged in the path of the car when near the end of the top and bottom of the shaft, so that in case the car should ever move beyond its normal limit of travel it will strike said projections, thereby operate the contacts, and cause the magnet to actuate the stop-valve, and thus automatically stop the engine and prevent the car from being moved too far in the shaft. Instead of these contacts and projections being on the the shaft or car, they may be on the guides and piston-rod or cross-head of the hoisting-engine, to operate in case the cross-head moves beyond its normal limit, and thus check the movement of the car in a similar way.

My present invention, therefore, consists mainly, in the features above outlined, and also in minor features and in details connected therewith, as hereinafter fully set forth and claimed.

In the drawings annexed, Figure 1 presents an elevation of a hydraulic elevating apparatus provided with my improvements. Fig. 2 is an enlarged fragmentary sectional plan of the engine-cylinder and its electric valve-operating mechanism. Fig. 3 is an enlarged sectional elevation of one of the contacts which determine the automatic limit of the car's movement. Fig. 4 illustrates a modification of the electric valve-operating mechanism. Figs. 5 and 6 illustrate different forms of magnets used to control the safety stop-valves. Fig. 7 gives an elevation of a hydraulic hoisting apparatus similar to that in

Fig. 1, but with some modifications and additional features not shown in Fig. 1. Fig. 8 illustrates a detail of Fig. 7—viz., the safety-catches on the car. Figs. 9 and 10 show a different form of safety stop-valve with different forms of magnets for controlling them. Fig. 11 illustrates the safety stop-magnet applied to the belt-shipper in hoisting-machines driven by belts from a power-shaft.

In Figs. 1 and 7 I have shown a well-known form of hydraulic elevator, in which the engine-cylinder A is horizontal, closed at one end and open at the other. *f* indicates the piston-rod, which protrudes from the open end of the cylinder and connects to the cross-head *g*, which carries the movable sheaves *f'*, and is also provided with the guide-rollers *g'*, which roll on the guide-rods g^2. The cable *h* is fixed at one end near the closed end of the cylinder, as seen in Fig. 1, thence passes in loops over the fixed sheaves f^2 and movable sheaves *f'*, and connects at the opposite end to the car E in the usual manner, as illustrated in the drawings. Water is admitted behind the piston from an elevated tank through the pipe *a*, which is provided with the main stopping and starting valve B, which is of the usual double-acting balanced kind, (shown best in Fig. 2)—that is, the cylinder of the valve is provided with two pistons, *b b'*, joined by a rod, *c*. The stand-pipe *a* always opens between the pistons *b b'*, and thus renders the valve balanced, as will be understood.

In Fig. 2, *d* indicates the inlet port or pipe leading from the valve to the closed end of the engine-cylinder A, and *e* indicates the outlet or exhaust port leading from the valve to the lower tank, into which the spent water is exhausted when the car descends. When the valve is set, as shown in Fig. 2, water is admitted from the elevated tank to the engine-cylinder, and thus propels the piston forward to raise the car, while if the valve is shifted outward, so that the piston *b* passes beyond the pipe *d*, the water will be shut off from the tank and the pipe *d* made to communicate with the exhaust-pipe *e*, thus allowing the water to escape from the cylinder, and thus permitting the piston to retreat and the car to descend. When the valve is so moved that the piston *b* just covers the inlet port or pipe *d*, the piston and car will be stopped at any position desired. It will hence be seen that the general arrangement of the cylinder, piston, valve, &c., with the cable and car is of the ordinary character, and forms no part of my improvement. It may now be observed, however, that instead of employing a check-rope extending from the car to operate the main valve B in the usual mechanical manner, as heretofore, I operate the valve by electro-magnets through an electric circuit extended to the car, and by referring to Fig. 1, in connection with Figs. 2 and 4, this electric-valve mechanism will be readily understood.

k k' indicate two powerful solenoids placed in line with each other, with their cores or core k^2 connected to a valve-lever, *i*, of a small steam, air, or water engine, *l*, whose piston *l'* connects to the valve-rod *c* of the main valve B. The motion of the cores and the valve-lever *i* is limited by stops i^2, and it will be seen that when the core is attracted into one solenoid it will be retracted from the other, and the valve-lever will be moved over against one stop, so as to admit pressure onto one or the other side of the piston *l'*, and thus shift the valve-pistons *b b'*, so as to cause the car to ascend or descend, as will be readily comprehended.

Referring to Fig. 1, it will be seen that the solenoids *k k'* are connected by wires with a battery, *m*, and that wires 2 3 5 extend from the battery and solenoids to a pendent loop of cable, *n*, one end of which is fastened at the middle of the shaft, while the other end connects to the car, so that the cable hangs pendent from the car and is free to move therewith as the car ascends or descends. The wire 2 of the cable *n* extends from one pole of the battery *m* and connects to the switch *o* in the car, which switch has two seats, *o' o²*. The wire 3 extends from seat *o'* to one end of the solenoid *k*, while the other end of the solenoid connects by wire 4 with battery *m*. The other seat, o^2, is connected by wire 5 with one end of the other solenoid, *k'*, the opposite end of which connects by wire 6 with battery *m*. It will therefore be seen that if the switch *o* is placed in its mid-position, as shown in Fig. 1, both circuits from the battery *m* will be open and both solenoids inactive, and hence the core k^2 will lie neutral between the solenoids and tend to assume a mid-position, to which it will be constantly drawn by a pendent weight, *p*, which is attached to a chain, *p'*, which passes between rollers p^2, fixed midway between the solenoids, and connects to the middle of the core, as shown in Fig. 1; also in Figs. 2 and 4. When the core is, therefore, held in the mid-position shown in Figs. 1 and 4, we will assume that the valve-lever *i*, as well as the motor-piston *l'* of the water-valve pistons *b b'*, will all be in their mid-positions and the flow of water to or from the elevator-cylinder A will be shut off, and hence the elevator-piston and car will be at rest. If, however, the switch *o* be moved over on the seat *o'*, the current will now flow from battery *m* by wire 2 to switch *o*, seat *o'*, and wire 3 to solenoid *k*, and thence return by wire 4 to the battery, thus energizing the solenoid *k*, which will attract the core k^2 and move the valve-lever *i*, as seen in Fig. 2, so as to admit pressure on the side of the piston *l'* to move said piston, with the valve-pistons *b b'*, to the right, and thus admit water-pressure in the elevator-cylinder to lift the car. If, now, the switch be moved back to its mid-position, the circuit will be broken with solenoid *k*; but the piston *l'* and the main valve B will remain in the position shown in Fig. 2, so that the ascent of the car continues. If it is desired to stop the car at any point in the ascent, the switch *o*

moved over on the seat o^2 and the current will now flow from battery m by wire 2, switch o, seat o^2, and wire 5 to solenoid k', and thence by wire 6 to battery m, thus energizing the solenoid k', which will move the core k^2 and valve-lever i fully to the left, and thus reverse the valve of motor l and cause the pistons l' and $b\ b'$ to be moved toward their mid-positions, which is the position for stopping the car either in the ascent or descent; and when the core k^2 and pistons l' and $b\ b'$ are thus brought into said mid-position, which will be made known to the operator by the full stoppage of the car, he then moves the switch back to its mid-position, thus breaking circuit on the left solenoid k', and thus leaving the valve-lever i and the pistons $l'\ b\ b'$ in the mid or stopping position described. In this mid-position of the valve-lever i it will be understood from Fig. 2 that all ports of the valve-motor l will be closed, thus retaining the pistons l' and $b\ b'$ in the mid-position, and thus keeping the car stationary as long as required. If it is desired to again ascend after a stop, the switch will be moved over on the seat o', as before; but if it is desired to descend, the switch will be moved back on the seat o^2, which will put the left solenoid k' again in circuit, and which will now draw the core k^2 from its mid or stopping position to its full stroke to the left, thus again opening the valve of the motor l and causing the pistons l' and $b\ b'$ to move to their full extent to the left, thus allowing the exhaust of water from the elevator-cylinder A and thereby causing the car to descend. To stop the car in the descent, the switch is moved over onto the seat o' until the valve is shifted to the mid-position, as before described, when the switch is moved back again into the mid-position to stop the valve mechanism in said mid-position, as will be understood. Hence to ascend, the switch is always moved over onto the seat o', and when the car is in motion the switch is moved to mid-position. To stop in the ascent, the switch is moved onto seat o^2 until the car is brought to rest, when the switch is at once thrown over to its mid or neutral position. To descend, the switch is placed on seat o^2 until the car is found to move downward, when the switch is put in its mid-position. To stop in the descent, the switch is put on seat o' until the car stops, when the switch is at once placed in its neutral position.

It will be noted that by having the piston l' of the small motor l connected to a balanced valve, B, that the motor may be quite small and work the valve effectively, and that the auxiliary valve on the motor may be made very small and light, and can thus be easily operated by electro-magnets, as shown. It will be seen on reference to Fig. 2 that the small valve motor l is of course double acting, and that the valve attached to valve-lever i is a rotary double-acting inducting and exhausting valve.

In some cases the core of the solenoids might be connected directly to the valve-rod c, as indicated in Fig. 4, so as to operate the water-valve B by direct attraction. Fig. 4 also shows that the solenoids may be wound in parallel sections or multiple arc, all the sections connecting at one end to a common return-wire to the battery m, while each section connects at the opposite end to a distinct switch-seat, on which the switch o may be turned successively to throw more or less of the sections into circuit and thus admit the current gradually to the solenoids and enable the force of the same to be regulated as may be required, which method is well known to electricians, and needs no further illustration.

In Fig. 2 I show the piston of a dash-pot, j, connected to the valve-lever i, to retard the action of the solenoids and prevent too sudden or jerky motions, as commonly employed in similar electric mechanism. It will now be seen that by this system of working the main starting and stopping valve of the elevator by magnets controlled by a circuit from the car not only can the valve be made to act very promptly, but the operator in the car is relieved from the serious exertion required to operate the usual check-rope and its mechanical adjuncts, and requires only to move a light switch in the car, which is of course done with great ease and quickness, and will enable the car to be stopped and started much more quickly and with greater safety, and will obviate the use of the endless check-rope and the cumbersome adjuncts of the usual mechanical valve mechanism, and thus accomplish a great improvement in the operation of elevators. It will now be readily understood that, in case the main valve B should become at any time deranged or unmanageable, so as to fail to close when the car or piston reached their normal limits of movement, the piston would tend to move out of the end of the cylinder and force the car up against the top beams of the shaft, or out through the roof of the building, and thus cause an entire wreck of the apparatus, this being, in fact, a form of accident to which elevators are quite liable, and which occurs usually by the breakage of the check-rope or other derangement of the valve mechanism. In order, therefore, to prevent this form of accident, I employ, in addition to the main valve B, a safety stop-valve, C, which I introduce in the pipe d, between the main valve B and the engine cylinder A, as shown both in Figs. 1 and 7; and I also prefer to introduce a second safety stop-valve, D, in the stand-pipe a, between the main valve B and the elevated tank, as shown in Fig. 1. These valves C and D may be of the ordinary sliding-gate kind, as indicated in Figs. 1 and 7, or of the double seat balanced kind, shown in Figs. 9 and 10, both forms of valves being well known and sufficiently illustrated in the drawings as to require no further description. Now, both of the stop-valves C D are normally held open by the agency of electro-magnets F G, so that they do not affect the passage of water to or from the cylinder, and hence do not interfere

with the action of the main valve B in controlling the movements of the car. The stems of the valves C D connect to weighted valve-operating levers *r r'*, which are engaged and held up by the armature detent levers *s s'*, thus holding the valves open. The magnets F G are placed in electric circuits which are completed through contacts H H' at the top and bottom of the shaft, and also through contacts K K' at each end of the cross-head guides, so that if at any time the cross-head or the car move beyond their normal limits one or the other of the contacts will be operated, and the magnets F or G energized to move their armatures, and thus cause the detents *s* or *s'* to release one of the weighted levers, which will at once fall and close its valve, thus stopping the further movement of the piston or car, and thus effectually preventing any accident or wreck of the apparatus. The magnet F is represented as a polarized electro-magnet, and the magnet G as a common electro-magnet, both, however, being placed in an open circuit with the battery I. The body of the magnet F, as shown best in Fig. 5, is of course a permanent magnet with a soft-iron armature wound with a coil, which is the only part of the magnet in circuit, as seen in Fig. 1, the said coiled armature being connected with the detent-lever *s*. The armature of the magnet F is hence held normally attracted by the permanent magnetism, and thus holds the detent-lever engaged with the raised valve-lever *r*; but as soon as an electric current is sent through the armature-coil of the magnet the attraction of the permanent magnet is neutralized and the armature falls off, thus moving the detent and allowing the lever *r* to fall and close the valve D. The magnet G being a common electro-magnet, its armature, which is part of the detent *s'*, is normally retracted, and hence holds the detent engaged with the raised valve-lever *r'* in said retracted position; but as soon as a current is sent through the coils of the magnet it attracts its armature and thus releases the weighted valve lever and allows the valve to close.

Fig. 6 shows how the magnet F may be modified by having the coils on the poles of the permanent magnet instead of on the soft-iron armature, as will be readily understood.

Referring to Fig. 3, the construction of the contacts H H' at the top and bottom of the shaft will be readily understood.

50 represents a sliding rod mounted in eye-brackets on the side of the shaft, and having one end projecting out at right angles in the path of the car, so that when the car moves beyond its normal limit it will collide with and move the bent rod. This rod is connected by the spring 51 with the contact-bolt 52, which projects through the top of a non conducting dust-proof box, 53, fixed on the side of the shaft, and which incloses the contacting-head 54 of the bolt, and also incloses two contact-tongues, 55, which project from binding-posts on the top of the box and approach the tapering contact-head 54. The circuit-wires connect to the binding-posts on the top of the box, and hence when the bolt is moved outward its head 54 will pass between the tongues 55, and thus close the circuit. A stop-collar, 56, on the bolt limits the outward movement of the bolt, and a spring, 57, tends constantly to retract the bolt, and thus keep the contact open, as shown in Fig. 3.

Referring to Fig. 1, it will be understood that the contacts H H' are placed at the top and bottom of the shaft at points a little beyond the normal travel of the car, so that, hence, if at any time the car travels up beyond the normal limit it will strike the bent rod of the upper contact H, and thus raise the same and close the contact, which will at once close the circuit from the battery I on the upper magnet, F, and the current will therefore take the following course: From battery I, by wire 20, to armature-coil of magnet F, thence by wire 21 to contact, H, and from contact H, by wire 22, back to opposite side of battery. Hence this closure of the circuit will at once throw off the armature-detent *s* and release the weighted lever *r*, which will fall and close the stop-valve D, and thus shut off the flow of water from the tank to the cylinder, and thereby stop the further rise of the car. The elasticity of spring 57 will allow the rod to move a short distance with the car after the contact is closed, and before the movement of the car is checked by the closing of the valves, as will be understood. If, on the other hand, the car moves beyond its limit in descending, it will strike the lower contact, H', and therefore close it, as before described, and cause the current to flow to the lower magnet, G, and therefore close the lower valve, C, and thus prevent the further exhaust of the water, and therefore stop the descent of the car. When the contact H' is thus closed, the course of the current will be as follows: From the battery I by wire 23 to contact H', thence by wire 24 to magnet G, and returning by wires 13 and 10 to opposite side of battery.

The contacts K K' at the ends of the cross-head guides consist, as shown in Fig. 1, of simple spring-tongues separated from a metal base-plate, the tongues being placed in the path of the guide-roller *g'* at points a little beyond the normal limits of the travel of the cross-head; hence if the cross-head moves out beyond its normal limit it will close the outer contact, K', and the current will now flow from the battery I by wire 20 to magnet F, and thence by wire 28 to contact K', and from contact K' by wire 29 back to battery, thus energizing the magnet F and causing the upper stop-valve, D, to close and stop the further advance of the cross-head and the rise of the car, as before described. If the cross-head moves too far inward on the return-stroke, the roller *g'* will close the inner contact, K, and the circuit will then flow as follows: From battery I by wires 23 and 25 to magnet G, thence by wire 26 to contact K, returning by wire 27 to

opposite side of battery, thereby energizing magnet G and causing the lower stop-valve, C, to become released and closed, thus preventing the further retreat of the piston and descent of the car. It will therefore be seen that the upper stop-valve, D, stops the motion of the car going up, while the lower stop-valve, C, stops the motion going down, and that the magnets of these valves are placed in two circuits, one of which is controlled by the contacts in the shaft operated by the car, and the other of which is controlled by contacts on the piston-guides operated by the cross-head. If desired, however, but one valve may be used to stop the motion in both directions, as shown in Fig. 7, and hereinafter described, and but one set of circuits and contacts may be used—either those on the shaft or those on the engine—but the use of both is considered safest, as one acts as a check on the other.

Referring to Fig. 1, it will be readily seen that the safety guard-bars described in my aforesaid patent, No. 324,751, may be introduced in the circuit of the magnets F G, so that should any person collide with the guard-bars in attempting to enter or leave the moving car the movement of the colliding bar will close the circuits on the magnet F or G, and thus close the appropriate stop-valve and stop the motion of the car before the person can be crushed. To illustrate this application, I have shown a yielding guard-bar, *t t'*, at the top and bottom of the car, said yielding bar (which is a flexible cord or wire) being fixed at one end, while the other end is connected to one member of normally-open contacts *u u'* on the car similar to what is shown in Figs. 2 and 4 of my aforesaid patent. These contacts are placed in the circuits of the magnets F G, but by a different course from that already described. It will therefore be seen that if any obstructions lie in the way of the car in going up or down collision will be made with the bar *t* or *t'*, and the contact *u* or *u'* thus closed, and the magnet F or G thus thrown into circuit to close either valve C or D to stop the movement of the car before any damage can be done by such collision on the principle claimed in my aforesaid patent.

Besides the different means just described for automatically closing the stop-valves C D, I also prefer to provide the car with push-buttons 8 and 11 and with a switch, *w*, whereby the circuits on the magnets of either or both valves may be closed manually to stop the car intentionally at any point, should some emergency require it. The push-button 8 is connected between the wires 7 and 9, and it will therefore be seen that when the button is closed the current will flow from battery I by wire 7 through push-button to wire 9, to magnet F, and from thence by wire 10 to battery I, and hence the valve D will be closed to stop the up motion of the car, as before described. The push-button 11 is connected between the wires 7 and 12, and when the button is closed current will flow, as before, through wire 7, through push-button to wire 12, thence to magnet, G and from magnet by wires 24, 25, and 23 to opposite side of battery I. Consequently magnet G will be energized and the valve C will be closed to stop the down motion of the car. The switch *w* has one end connected to wire 9, and has two seats, 14 and 15, connected, respectively, to wires 7 and 12. Consequently if the switch is moved onto the seats 14 and 15 the circuit will be closed with both magnets, as will be readily seen by tracing the connections, and hence both stop-valves will be closed instantly, and the car restrained from motion up or down.

The advantage of having distinct valves C and D to control the up and down movements, and distinct push-buttons 11 8 to govern the magnets thereof, is that, in case an obstruction or accident is met with during the travel of the car in one direction, the car can be instantly stopped in that direction and then allowed to move in the opposite direction by shifting the main valve B, and when the car is moved opposite the next door it can be there instantly stopped by touching the other push-button, thus allowing the passengers to get out as soon as possible after the discovery of any derangement.

The dotted lines connecting Figs. 1 and 2 will show that, if desired, the solenoids *k k'*, which govern the action of the main valve B, may be placed in circuit with the contacts H H' or K K', so that when the car moves beyond its normal limits the main valve will be automatically shifted to stop the further movement of the car.

Referring to Fig. 2, it will be understood that the small engine *l*, for working the main valve B, may be supplied with steam or compressed air, or with water under pressure from the pipe *a*, or other motive fluid. In Fig. 1, however, I show an air-compressing device operated by the movement of the main cross-head to supply the valve-engine *l*. In this device *x* represents an air-pump with a gravitating piston connected with an elbow-lever, *x'*, one arm of which lies in the path of the cross-head *g* when near the end of its stroke, so that at each return movement of the cross-head the pump is operated to compress air into the reservoir *y*, from which the valve-engine *l* is supplied by pipe *y'*.

Referring to Fig. 7, it will be seen that the back contact, K, on the cross-head guides is the same as shown in Fig. 1; but the front contact, K', is of the character shown in Fig. 1, except that the contact-bolt is connected with a lever, *z*, the tip of which lies in the path of a projection on the cross-head when at the end of its outer movement. In this Fig. 7 it will be also seen that the stop-valve C is placed between the main valve B and the cylinder A, and consequently when it is closed it will prevent the movement of the car in either direction. This valve C is in this case presumed to be of the sliding-gate kind, which usually require considerable force to operate them,

and for this reason I have shown the stem of the valve connected not only to the weighted valve-lever r', as before, but also to a ram-piston, c', in a water-cylinder, d', which connects to the stand-pipe a through a valve, e'. Normally, of course, the valve e' is closed, the valve C is opened, and the piston c' and weighted lever r' are raised, the latter parts being held by the armature-detent s'. The valve e' has also a weighted valve-lever, c^2, which is normally raised and held by the lever c^2, which is engaged by a shoulder on the tip of the lever r'. The magnet G, which corresponds to the magnet G in Fig. 1, is in circuit with the contacts at top and bottom of the shaft and on the cross-head guides; and hence when any of said contacts are closed the magnet G will attract the detent s', and thus release the weighted lever c^2 and allow the same to fall, thus opening the valve e' and admitting the water-pressure on the piston c', which will forcibly close the valve C and stop the motion of the car in both directions. When the valve C is thus closed, the descent of the lever r' will close the contacts r^2, and thus close an electric bell circuit, $q\,q$, and ring a bell, q', to give notice to the engineer that some accident has occurred, to stop the apparatus. The course of the current to the magnet G, when the different contacts are closed, may be readily traced by referring to Fig. 7. Thus when the upper shaft-contact, H, is closed, the current will flow from battery I by wire 36 to contact H, and by wire 37 to magnet G, and thence return by wire 33 to battery. If contact H′ is closed, the current will flow from battery I by wire 34 to contact H′, thence by wire 35 to magnet G, and return by wire 33, as before. When contact K is closed, the current flows out of battery by wire 38 to contact, thence by wire 39 to magnet G, and returns by wire 33. If contact K′ is closed, current flows thereto by wire 40, thence by wire 41 to magnet G, and returns by wire 33.

In addition to the aforesaid circuits with magnets G, I also prefer to carry a wire, 30, from the battery I to the fixed end of the cable h, and from the car end of the cable I extend a wire, 31, to a push-button, 11, in the car E, and from the push-button I carry a pendent looped wire or cable, 32, to the magnet G, and complete the circuit through wire 33 to battery, this circuit being normally open at the push-button 11. By closing the push-button 11, however, it will be seen that the operator in the car can instantly close the circuit on magnet G, and thus close the stop-valve C to stop the car at any point should some emergency require it, as before described.

In Fig. 7 I also show the car provided with safety-catches 60 61, which are normally held out of engagement with the guides, but which may be released to engage the guides and thus stop the car when required. These catches consist of a spring-bar, 60, on the ends of which are pivoted double-toothed cam-shoes 61, as best shown in Fig. 3, which shoes will engage the guide in a wedging manner in either direction when released against the same. The toggle-spring 60 is, however, normally bent up so as to withdraw the shoes 61 from the guides, and are thus held by a chain or band, 62, wound around a drum, 63, on which a brake-band, 64, is tightened by a lever, 66, to hold said spring up. This brake-lever is engaged by the detent-lever 65, which carries a coiled armature which is attracted by the permanent or polarized magnet N, thereby holding the safety-catches out of engagement during the continuation of said attraction. I also provide the car with a governor, R, which is driven by the movement of the car in any suitable way—for example, from a friction-wheel, T, which rolls on the guides and is suitably geared to the governor, as illustrated. The movable collar of the governor is connected to a contact-lever, S, which is connected by wire 70 with the wire 31 or with the cable, as shown. A contact-seat, 71, below the tip of the lever S is connected with one end of the armature-coil of magnet N, while the other end of the coil connects by wire 72 with wire 32. It will therefore be now seen that in case the car at any time acquires an abnormal or dangerous speed in moving up or down the action of the governor will move the lever S and close contact 71, and thus close circuit on magnet N, which will at once release its armature and thus allow the brake-lever 66 to fall and thus release the safety-catches 60 and stop the car in the guides. At the same instant the circuit will also be closed on the magnet G and the stop-valve C closed to stop the movement of the engine simultaneously with the car. When the contact 71 is thus closed, the course of the current may be traced as follows: From battery I, by wire 30, to the cable h, and by wire 70 to lever S and contact 71, thence to coil of magnet N, and by wire 72 to wire 32, to magnet G, and by wire 33 back to battery I.

If desired, the magnet N and the safety-catches 60 may be omitted and the governor and its contact retained, so as to always act to energize magnet G and close valve C in case the car acquires an abnormal speed at any time, as will be understood.

Referring to Fig. 9, it will be seen that I have shown the magnet F attached directly to the top of the stem of the stop-valve D. When the stem is raised to open the valve, the magnet will adhere to a fixed soft-iron armature, (shown above the magnet,) and thus hold the valve open; but as soon as a current is sent through the coils of the magnet the attraction of the magnet will be neutralized and the magnet will fall and thus close the valve, as shown in Fig. 9. Hence this form of valve and magnet may be substituted for that shown at F D in Fig. 1.

In Fig. 10 the stem of the valve C is shown connected to a weighted lever, r', as in Fig. 1; but this lever is arranged to be attracted directly by the polarized magnet G, so as to normally hold the lever raised and the valve.

open by permanent magnetism. When a current is sent through the magnet-coil, however, its permanent magnetism will be neutralized and the lever will fall and close the valve, as shown.

In Figs. 1 and 7 I have shown my automatic electric stopping mechanism for limiting the movement of the car applied to a hydraulic elevator, in which the electro-magnet acts to close a valve to shut off the flow of the motive fluid to the engine; but the invention may of course be applied without any substantial change to elevators propelled by any other form of motor or by any other mechanical means.

In Fig. 11 I have shown the stop mechanism applied to hoisting machinery driven by belts. In this case P indicates the winding-drum of the elevator or hoist and U the worm-shaft which revolves the drum, this shaft being provided with the fast pulley 80 and the loose pulleys 81 82.

83 is a driving-belt having motion in one direction and 84 a belt having motion in the opposite direction, while 85 and 86 represent the belt-shippers thereof. These belt-shippers are presumed to be connected in the usual manner, (not shown,) with the check-rope extending to the car, so that by properly operating said check-rope the shippers may be so set as to throw either belt onto the fast pulley 80, and thus raise or lower the car, or throw both belts off the fast pulley onto the loose ones to stop the movement of the car. Each shipper is, however, also connected by chains 87 88 to a lever, 89, which is engaged by a weighted elbow-lever, 90, which is in turn engaged and held up by the armature-detent lever *s*, which is held attracted by the stop-magnet F with the same effect, as shown at F *s* in Fig. 1. The armature-coil of this magnet F is of course placed in circuit with the contacts H H′ on the shaft, as is sufficiently indicated by dotted lines connecting Figs. 7 and 11. It will now be seen that the chains 87 88, between the shipper and the lever 89, will allow the shippers to be moved back and forth by the check-rope mechanism to control the movements of the car without affecting the position of the levers 89 90 or the detent *s*. If, however, the car moves too far in the shaft, and thus closes one of the contacts H H′, the circuit will be closed on magnet F and the armature-detent *s* will at once fall and release the weighted lever 90, which, in falling, will move the lever 89, as shown by dotted lines, and thus pull on whichever chain happens to be taut, and thereby move the corresponding shipper and thus remove whichever belt happens to be on the fast pulley back onto the loose pulley, and thereby stop the movement of the car, as will be readily comprehended. It will be understood that any equivalent electric motor devices might be used in place of the electro-magnets shown—that is, any device in which mechanical force is produced by electricity; but at present I consider electro-magnets the only desirable form of electro-motor device, and at the same time where I claim magnets I assume it to be understood that I also include equivalents thereof.

It will be noted that in most instances I employ polarized electro-magnets in an open circuit, which have great advantages for my purposes, as they hold constantly during the normal condition of the elevator apparatus without consuming current, and when the circuit is closed they have the advantage of releasing their armatures very quickly, which is a great advantage in the stopping mechanism shown; but of course a closed circuit with normally-closed contacts and normally-energized magnets might be used, if desired.

It will be seen that the governor R and its adjuncts, as shown in Fig. 7, may be driven by the movement of the engine as well as by the movement of the car, and it will be observed that the employment of a governor to close a stop-valve or stopping device through the agency of a magnet and electric circuit forms one of the novel features of my invention.

It will be readily seen that the stopping-contacts H K on the shaft or engine may also be in circuit with the magnet N of the safety-catches on the car, so that when said contacts are closed by the movements of the car or engine beyond the normal limits the safety-catches on the car will be released to stop the same.

Referring to Figs. 1 and 7, it will be seen that the weight with which the valve-lever *v* is loaded is connected to the lever by an interposed spring, which cushions the momentum of the weight and prevents shock.

What I claim is—

1. The combination, with an elevator car and mechanism for stopping the same, of a magnet operatively connected with the stopping mechanism and arranged to normally hold the same inactive, and an electric circuit connected with said magnet, provided with a contact or contacts arranged relatively to the terminal movements of the hoisting apparatus, substantially as herein described, whereby the terminal movement of the apparatus beyond the normal limits operates said contact and causes the magnet to release the stopping mechanism to stop further movement.

2. The combination, with an elevator-car and its hoisting engine or machinery, of a valve or equivalent stopping device for stopping the motion of the engine, a magnet arranged to normally hold said stopping device inactive, and an electric circuit connected with said magnet and provided with a contact or contacts so arranged relatively to the terminal movements of the elevating apparatus that in case the car or engine moves beyond its normal limits said contacts are operated and the magnet actuated to release the stopping device to stop further movement.

3. The combination, with an elevator-car and its hoisting-engine, of a valve or stopping

device for stopping said engine, with a magnet operatively connected with the valve or stopping device and arranged to normally hold it inactive, with one or more electric contacts on the shaft in the path of the car when near the end of its movement, and an electric circuit between said contacts and magnet whereby the movement of the car beyond its normal limits operates said contacts and thus actuates the magnet to release the stopping device to stop the car, substantially as herein set forth.

4. The combination, with an elevator-engine, of an independent safety stop-valve, C, arranged between the engine-cylinder and its main valve B, and an electric motor device operating said valve, substantially as shown and described.

5. The combination, with an elevator engine, of a safety stop-valve arranged to check the motion thereof, a loaded lever arranged to close said valve, a detent arranged to hold said lever inactive, and an electro-magnet arranged to release said detent, substantially as and for the purpose set forth.

6. The combination, with an elevator-car and its hoisting-engine, of a valve, C, controlling the down motion of the car, and valve D, to control the up motion of the car, with magnets F G, arranged to hold said valves open, with electric circuits extending to the car from said magnets, and means for controlling the circuit of either magnet independently in the car, substantially as set forth.

7. The combination, with an elevator-car and its hoisting-engine, of a valve or its equivalent controlling the stopping or starting of the engine, with an electro magnet or magnets arranged to control the shifting of said valve, circuit opening or closing devices arranged at a distance from said valve and magnets, and an electric circuit in which said magnets and circuit opening and closing devices are included, substantially as herein set forth.

8. The combination, with an elevator-car and its hoisting-engine, of a valve or its equivalent controlling the stopping and starting of the engine, with a magnet or magnets arranged to control the shifting of said valve, an electric circuit extended from said magnet to the car, and means for breaking and closing said circuit in the car, substantially as herein set forth.

9. The combination, with an elevator-car and its hoisting-engine, of a balanced mechanical valve controlling the movements thereof, an electro magnet or magnets arranged to control the movement of said valve, and an electric circuit extended from said magnets, and means for breaking and closing said circuit at a distance from said engine, substantially as herein shown and described.

10. The combination, with an elevator-car and its hoisting-engine, of a valve to control the movements of the engine and car, and a valve motor or engine arranged to move said valve, with an electro magnet or magnets controlling the movements of said valve-motor, and an electric circuit extended from said magnets to the car, with means for breaking and closing the circuit in the car.

11. The combination, with an elevator-car and its hoisting-engine, of a valve controlling the motion of said engine, a small fluid-pressure motor operatively connected to said valve, and an electrically-actuated auxiliary valve controlling said valve-motor, and operative electric connections extended to the car, substantially as set forth.

12. The combination, with an elevator-car and its hoisting-engine and a valve controlling the movements of said engine, of a small fluid pressure motor operatively connected to said engine-valve, an auxiliary valve controlling said valve motor, and an electro magnet or magnets operating said auxiliary valve, substantially as herein set forth.

13. The combination, with an elevator-car and its hoisting-engine and a main valve controlling the said engine, of a small fluid-pressure motor external to said main valve, operatively connected therewith, but supplied with motive fluid separately therefrom, and an independent auxiliary valve controlling said valve-motor, substantially as shown and described.

14. The combination, with an elevator-car and its hoisting-engine and a main valve controlling the motion of said engine, of a motor-cylinder closed at each end and a double-acting piston working therein and operatively connected to said valve, with double-acting auxiliary valve-controlling induction and eduction ports between said cylinder and a source of motive fluid, and an electric motive device or magnet actuating said auxiliary valve, substantially as set forth.

15. The combination, with an elevator-engine, of a small fluid-pressure motor, such as *l*, and an electrically-actuated valve controlling the motion thereof, with the main valve-cylinder B connected to said engine. the double piston-valve *b b'* in said cylinder, connected to and actuated by said motor, and the ports *a e d* in said cylinder, arranged and operating substantially as shown and described.

16. The combination, with an elevator-car and its hoisting-engine and a main valve controlling the engine, of a small double-acting fluid-pressure motor connected to and operating said valve, an auxiliary double-acting inducting and exhausting valve controlling said motor, two electro-magnets arranged, respectively, to move said valve in opposite directions, and circuit-connections operating the magnets, substantially as herein set forth.

17. The combination, with an elevator-car and its hoisting-engine and a valve controlling said engine, of a motor to work said valve, an auxiliary valve controlling said motor, a double armature-core connected to said valve, and two solenoids or tubular magnets arranged to shift said core and its connected valve in opposite directions, substantially as and for the purpose set forth.

18. The combination, with a suddenly-releasable valve, such as C or D, controlling a fluid-passage, of an operating bar or lever arranged to actuate the same, a detent holding said bar inactive, and an actuating-weight hung to said bar by an interposed spring, substantially as shown and described.

19. The combination, with a motor or engine, such as *l*, and a valve controlling the same, of two fixed electro-magnets arranged to shift said valve in opposite directions, and the fixed stops *i*², limiting the attracting motions of said magnets, substantially as shown and described.

20. The combination, with an elevator-car and its hoisting-engine, of a valve or stopping device to stop the engine, and a governor responding to increases of speed in the movement of the car or engine, with an electric contact operatively connected with a movable part of the governor, a magnet operatively connected with the stopping device, and an electric circuit between said magnet and contact, arranged and operating substantially as and for the purpose herein set forth.

21. The combination, with an elevating apparatus and with a stopping device or devices for stopping the motion of the same, of a polarized electro-magnet arranged to hold the stopping device normally inactive by the attraction of permanent magnetism, with a normally-open electric circuit connected with the coil of said magnet, and means, substantially such as set forth, for closing said circuit in emergencies, and thus neutralizing the magnet and releasing the stopping device.

22. The combination, with an elevator-engine and with the main stopping and starting valve thereof, of a small fluid motor or engine for actuating said valve, and a fluid-pump for supplying said engine, having its piston connected to an actuating device arranged in the path of a movable part of the elevator-engine and operated thereby, substantially as herein shown and described.

ROBERT M. CURTISS.

Witnesses:
JNO. E. GAVIN,
CHAS. M. HIGGINS.

(No Model.)

C. E. ONGLEY.

SAFETY APPARATUS FOR ELEVATORS.

No. 389,853. Patented Sept. 18, 1888.

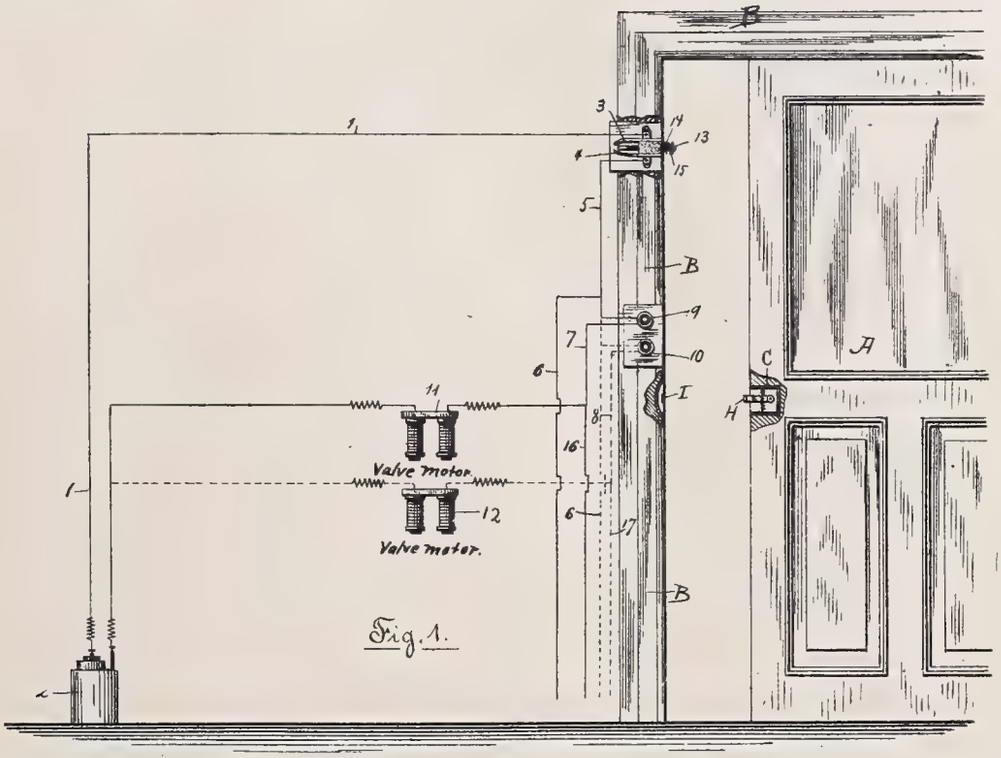


Fig. 1.

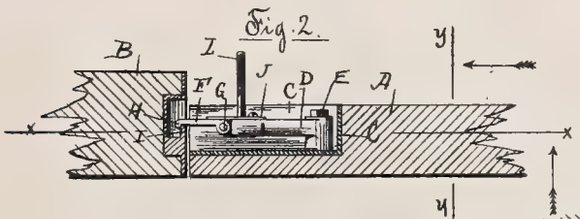


Fig. 2.

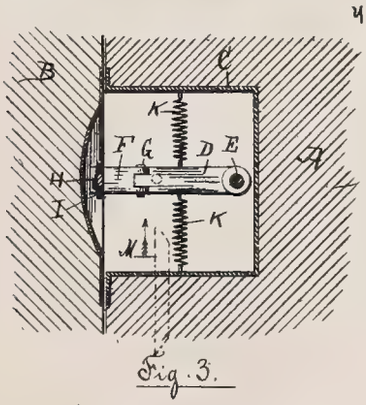


Fig. 3.

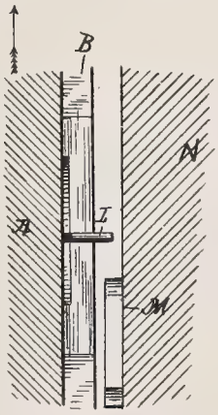


Fig. 4.

Witnesses
George H. Botts
J. J. Kennedy

Inventor
Charles E. Ongley

By his Attorneys
Philipp Philipp & Hovey

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES E. ONGLEY, OF NEW YORK, N. Y.

SAFETY APPARATUS FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 389,853, dated September 18, 1888.

Application filed November 21, 1887. Serial No. 255,720. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. ONGLEY, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in Safety Apparatus for Elevators, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

My invention relates particularly to that class of elevators in which electrical appliances are employed for controlling the movements of the elevator-car; and it has for its object to provide an efficient safeguard against accidents caused by starting the car from a landing before the door of the shaft has been closed.

The invention consists, primarily, in a circuit-breaking device controlled by the door, so that the electric circuit through which the movements of the elevator are controlled is only maintained closed when the door is closed.

In the accompanying drawings, Figure 1 represents a portion of a doorway to an elevator-shaft with the devices embodying my invention; also a connected diagram representing an electric circuit and illustrating the operation of my improved safety appliance. Fig. 2 is a sectional view of a part of the door and casing, showing a top view of the door-latching device by which the door leading to the elevator-shaft is fastened. Fig. 3 is a sectional view on line X X of Fig. 2 of a part of the door and casing, showing a front view of the door-latching device; and Fig. 4 represents in sectional view on line Y Y of Fig. 2 a portion of the door and also a portion of the car, and illustrating the manner of unlatching the door leading to the elevator-shaft by the action of the car.

Referring to said figures, A denotes one of the doors which open into the shaft of an elevator.

B is a portion of the door-casing.

C is a case or shell recessed in the body of the door and within which is pivoted the latch consisting of a bar, D, pivoted upon a stud, E, and turning in a vertical plane parallel with the door A.

Upon the end of the pivoted bar D is a short bar, F, hinged to the bar D at G, and provided at its outer or free end with a hook, H, arranged to engage a lip, I, on the door-casing. The hinged bar F is held in alignment with the pivoted bar D by means of a blade-spring, J, attached to the bar D and resting against the side of the bar F. The hook H is beveled, so that the bar F will be turned on its hinged joint as the door is closed and allow the bar F to automatically engage the lip I, which is a part of a metallic shell recessed in the edge of the door-casing B. The bar D is held in a central or horizontal position, as shown in Fig. 3, by means of the two equalizing-springs K, and from the sides of the bar D a pin, L, extends laterally toward the elevator-shaft, so as to come in the path of a cam, M, projecting from the car, which in Fig. 4 is represented by the sectional part N. Whenever the door A is closed, the hinged portion F of the latch will automatically engage the lip I on the door-casing and hold the door securely fastened until the car, in either ascending or descending, operates the latch to release the door by means of the cam M, which is brought into contact with the pin L and rocks the bar and connected hooking-latch until the hooked end H is carried past the lip I. As the car passes the door, the pin L will pass out of engagement with the cam M, and the hook H will re-engage with the lip I. The bar D is therefore held in the position shown, with the hooked bar F, engaging the lip I, holding the door latched except during the time that the door-opening is closed by the presence of the car. The door also becomes automatically latched whenever it is closed.

11 and 12 represent electromotors, which operate the valve or other starting and stopping mechanism of the car in any suitable manner—as, for example, in the manner described in my companion application for Letters Patent filed November 22, 1887, Serial No. 255,857—and 2 represents the battery for operating the motors.

The wire 1, leading from the battery, is connected with an insulated elastic blade or brush, 3, which is located in the door-frame and adjacent to a second elastic blade or brush, 4, which is connected by wires 5 with push-buttons or circuit-closers 9 10, located at each landing and connected by wires 7 8 with the respective motors and the battery. The wires

5 and 7 8 are also connected by wires 6 and 16 17 with similar push-buttons or circuit-closers located upon the car. Between the elastic blades 3 4 there is arranged a sliding circuit closer and breaker, 13, having a spring, 14, which acts against a collar, 15, on the circuit-closer, in the usual and well-known manner, to normally hold it in the position shown in Fig. 1 out of contact with the elastic blades 3 4, thus breaking the circuit through the wire 1. The circuit-closer 13 is located in such position that when the door A is closed it is pushed in against the tension of the spring 14 until its end is brought in contact with both of the elastic blades 3 and 4, thereby electrically connecting them and also the wires 1 5, and permitting the circuits, including the electromotors, to be completed, at the will of the operator, through the use of the push-buttons 9 and 10 or the similar buttons on the car. Whenever the door A is open, the spring 14 will cause the circuit-closer 13 to be withdrawn from between the two elastic blades 3 and 4, thereby breaking the circuit and preventing the operator from causing either of the electromotors to actuate the elevator starting and stopping mechanism.

The operation of the apparatus thus organized is as follows: In order to start the car from any position, it is first necessary that all of the doors leading to the shaft should be closed, because so long as any door is open the connection between the wires 1 5 will be broken and it will be impossible to complete the circuit through either of the electromotors 11 12 to start the car. The doors being all closed, so as to complete the connection between the wires 1 5, the car can be started either up or down from any position by operating the proper push-button either upon the car or at any one of the landings. When the car arrives at the proper landing, it will be stopped by operating the other push-button. As the car arrives in proper position to be stopped, it will operate the bar D and release the door, so that it can be opened, and the door having been opened the car cannot be again started until the door is closed. It will also be observed that by reason of this arrangement it is not only necessary that the door should be closed before the car is started, but that the car should be fully stopped before the door is opened.

Although it will in many cases be desirable that provision should be made for stopping and starting the car from the landings, this is not in all cases necessary, and may of course be omitted without departing from the invention.

What I claim is—

The combination, with an electric circuit including an electromotor, by which the elevator starting and stopping mechanism is operated, of a circuit closer and breaker located in said circuit and operated by the door of the elevator-shaft to break the circuit by the opening of the door, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES E. ONGLEY

Witnesses:

T. H. PALMER,

J. J. KENNEDY.

(No Model.) 2 Sheets—Sheet 1.

W. B. CABOT & R. M. BRADLEY.

ELEVATOR.

No. 398,699. Patented Feb. 26, 1889.

Fig: 1.

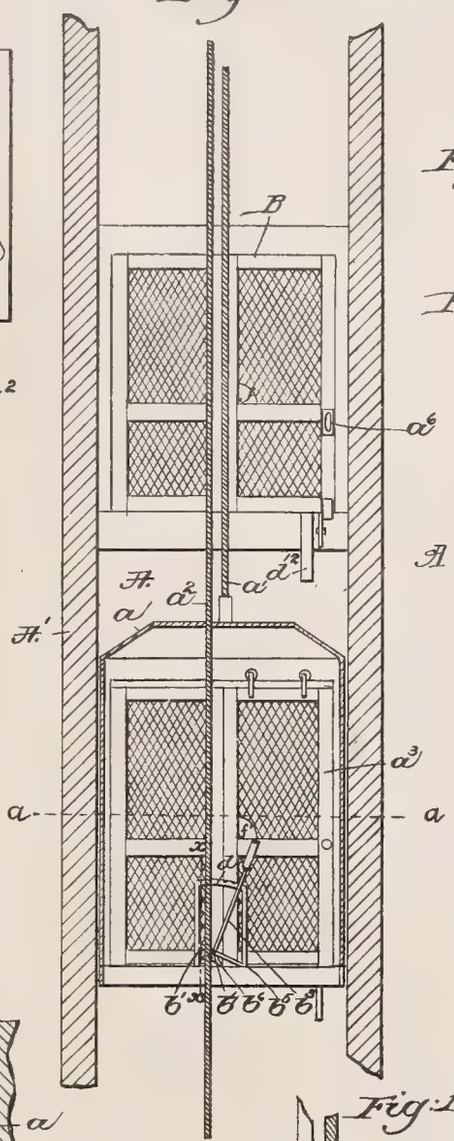


Fig: 9.

Fig: 6.

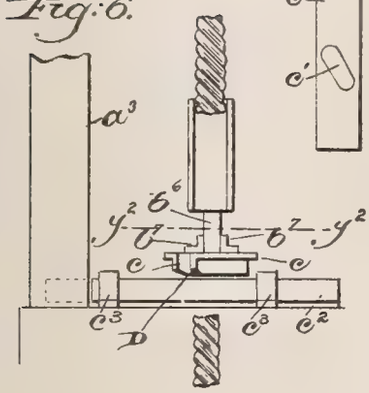


Fig: 4.

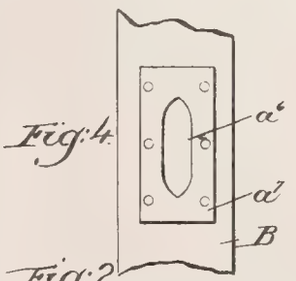


Fig: 2.

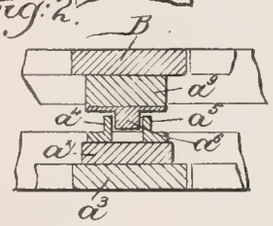


Fig: 3.

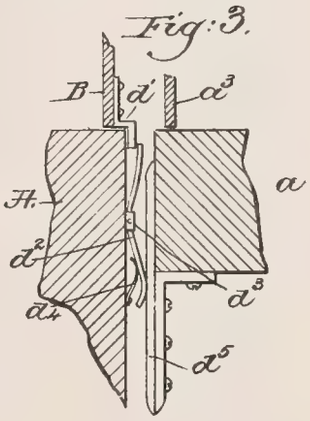


Fig: 8.

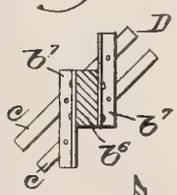


Fig: 11.

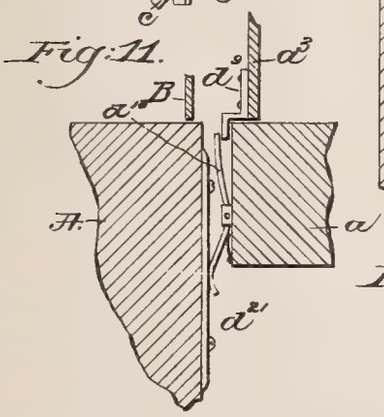


Fig: 7.

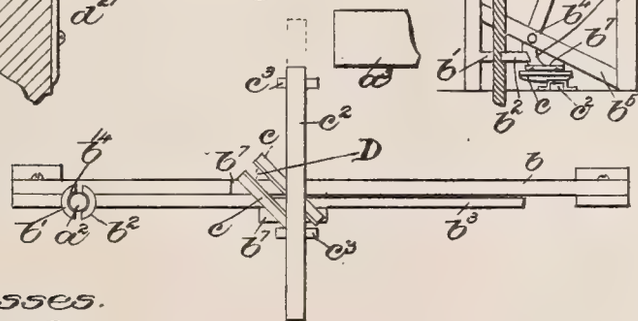


Fig: 10.

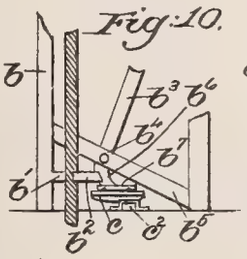
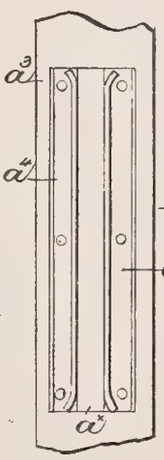


Fig: 5.



Witnesses.
Fred. L. Emery
Fred L. Emery.

Inventors.
William B. Cabot.
Richards M. Bradley
by Crosby & Gregory
Attys

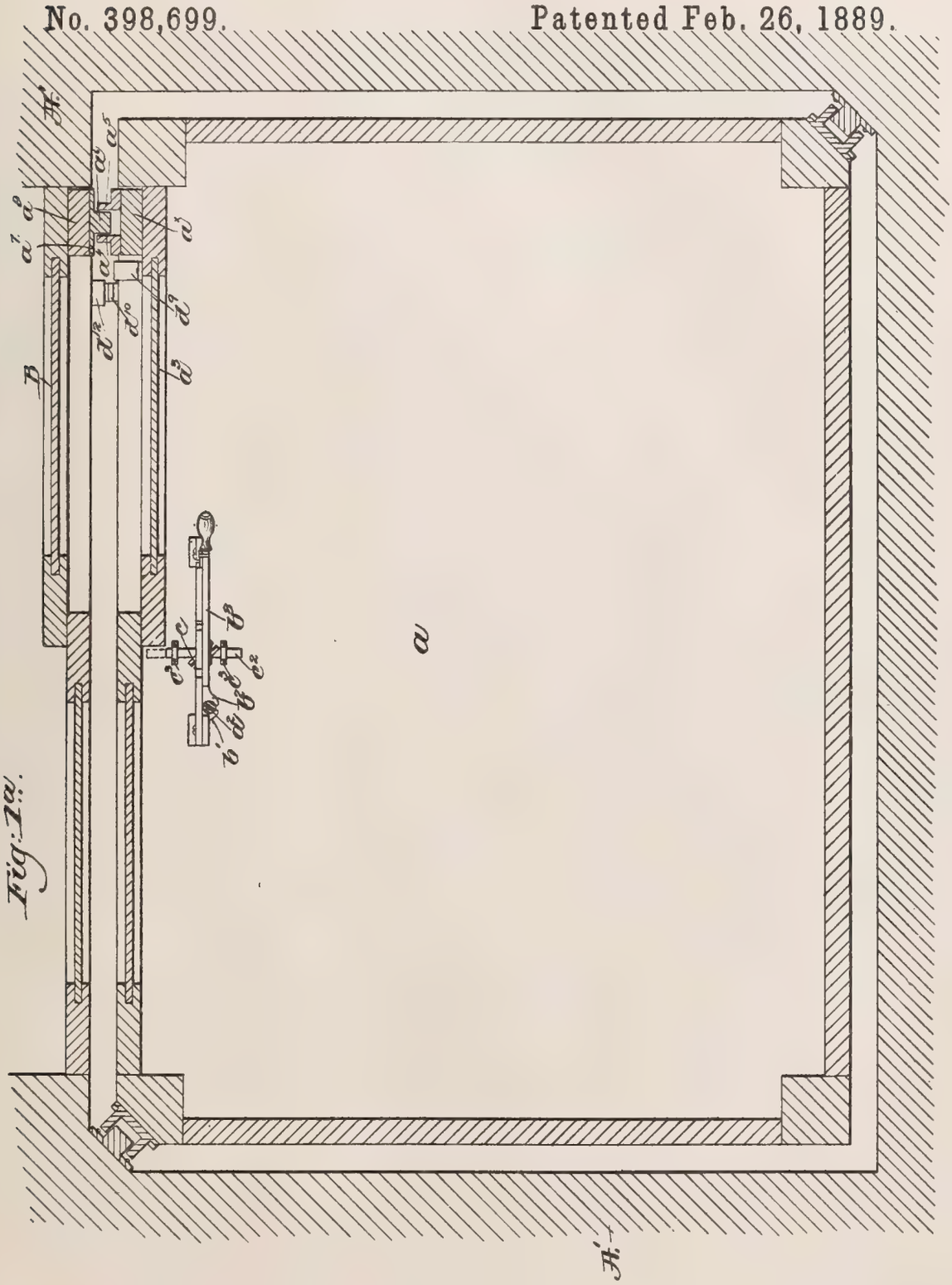
THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

W. B. CABOT & R. M. BRADLEY.

ELEVATOR.

No. 398,699. Patented Feb. 26, 1889.



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Frederick L. Emery.

Inventor.
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Richards M. Bradley,
by Emery & Gregory
attys

THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM B. CABOT, OF WEST MEDFORD, AND RICHARDS M. BRADLEY, OF BOSTON, MASSACHUSETTS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 398,699, dated February 26, 1889.

Application filed December 8, 1887. Serial No. 257,300. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM B. CABOT, of West Medford, county of Middlesex, State of Massachusetts, and RICHARDS M. BRADLEY, of Boston, county of Suffolk, and State of Massachusetts, have invented an Improvement in Elevators, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to elevators, and more especially to that class known as "passenger-elevators," it having for its object to provide suitable means, as will be described, whereby accidents may be diminished and avoided, and thereby greater safety secured to persons using the elevator.

The particular features in which our invention consists will be pointed out in the claims at the end of this specification.

Figure 1 is a section of a sufficient portion of an elevator well or shaft and car therein to enable our invention to be understood, the section being taken on line a' a', Fig. 1^a; Fig. 1^a, a transverse section of the car and a portion of the walls of the shaft or well to more clearly show the invention, the section being taken on line a a, Fig. 1, the car-door being opposite a door in the shaft or well; Fig. 2, a sectional detail of part of the car and car-door, with the latter opposite the shaft-door, the said section being taken on line a a, Fig. 1; Fig. 3, a partial vertical section taken at the bottom of the car to show the means employed for unlocking the shaft-door, the figure also showing part of the shaft and shaft-door; Figs. 4 and 5, details to be referred to; Fig. 6, a view of part of Fig. 1 on line x x, looking toward the right; Fig. 7, an under side view of the clamping mechanism detached from the car; Fig. 8, a sectional detail, to be referred to, the section being taken on line y^2 y^2, Fig. 6; Fig. 9, a detail of the bolt for locking the car-door; Fig. 10, an enlarged detail, to be referred to; and Fig. 11 is a modification of Fig. 3, showing the lever and spring attached to the car instead of the shaft and the button to the shaft instead of to the car.

Referring to Fig. 1, A represents an elevator shaft or well formed by the walls A′ of a building or other structure, the said shaft or well having doors B at the landings or floors of the building, only one shaft-door being herein shown. Within the elevator shaft or well is a car, a, suspended in usual manner by one or more ropes, a', passed about sheaves at the top of the building and connected to the hoisting-engine, usually located in the basement of the building, the said engine and sheaves (not herein shown) being substantially as common to the Whittier and other well-known elevators.

As shown in Fig. 1, the operation of the hoisting-engine referred to is controlled by a shipper-rope, a^2, extended through the car a, provided with the usual door, a^3, and forming part of the operating mechanism of the car. This door a^3 (see Fig. 2) has attached to it on its outer side two guides, a^4 a^5, herein shown as angle-irons, secured, as shown, to a wooden or other block, $a^\times$, the said guides co-operating with a stud or projection, a^6, herein shown on a plate, a^7, secured to a block, a^9, connected to or forming part of the shaft-door B, the said guides passing astride the said stud or projection when the car in its ascent or descent passes a door in the shaft or well, the said stud and guides constituting an interlocking device or door-connection to unite the said doors.

The car is made to travel, as herein shown, by operating the shipper-rope a^2, which has co-operating with it a holding device, herein shown as a clamp or holder, one half, b', of which is attached to a frame, b, of ordinary construction erected upon the floor of the car a, the other half, b^2, of the said clamp being secured to or forming part of a lever, b^3, pivoted, as shown at b^4, to a cross-brace, b^5, of the frame b, the said holding device engaging the shipper-rope to stop the car when the lever b^3 occupies the position shown in Fig. 1, the car at such time being supposed to be opposite a door in the elevator shaft or well, the said frame and part connected thereto being more clearly shown in Fig. 10. Each half-clamp b' b^2 is preferably provided with a cushion, b^{14}, of leather or other suitable material, (see Fig. 7,) to prevent injury to the shipper-rope when it is clamped as described.

The lever b^3 has an arm, b^5, (see Figs. 1, 6, and 10,) to which is secured a bolt-actuating device, D, herein shown as composed of two parallel bars, c c, attached by angle-irons b^7 to opposite sides of the said arm.

The bars c c are arranged diagonally to the movement of the lever b^3, and receive between them a stud, c', of a bolt, c^2, and upon movement of the lever cause the bolt c^2 to slide in suitable guides, c^3, the said lever, through the bolt-actuating device D, serving to move the said bolt forward to place it behind and in the path of movement of the car-door a^3, to thus lock the said door, or upon movement of the lever to move the said bolt backward to withdraw it from behind and permit the door to be opened, as desired.

When the lever b^3 is moved to its position shown in Fig. 1, which occurs when the car has arrived opposite a door in the elevator shaft or well, the shipper-rope is clamped and the bolt is withdrawn from the dotted to the full-line position shown in Fig. 6, thus leaving the door a^3 free to be opened; but when the lever b^3 is moved forward or into engagement with a notch, d, in the frame b the shipper-rope is released or unclamped, and the bolt c^2 is at such time moved into its dotted-line position behind the car-door, as shown in Figs. 6 and 7, preventing the latter being fully opened while the car is in motion. It will thus be seen that it is impossible to start the car until the lever is moved to release the shipper-rope, and the shipper-rope cannot be released until after the car-door is closed, the closing of the car-door permitting the bolt c^2 to be moved by the said lever into position behind the car-door to lock the same.

As the car-door is shut, the shaft-door opposite which the car has stopped will be shut at the same time, it being locked to the car-door, as above described. To prevent the door of the elevator-shaft from being opened from the outside until the car has arrived substantially opposite it, the said shaft-door on its inner side has attached to it, as shown, a cam or angular projection, d', (see Fig. 3,) with which co-operates a spring-actuated lever, d^2, pivoted, as herein shown, to a stud, d^3, secured to the wall of the shaft, the said lever being acted upon by the spring d^4, to normally keep the end of the said lever in the path of movement of the cam or projection d', the said lever and cam or projection forming a latch or locking device by which the shaft-door is locked until the lever d^2 is moved out of the path of movement of the said shaft-door, as will be described.

The car a, as herein shown, has secured to it a cam or projection, d^5, which we shall hereinafter designate as a "button," the said button being so located on the car as to act upon the lever d^2 to move it away from the projection d' when the stud or projection a^5 is near its central position in the guideway a^4 a^5. The shaft-door is now free to be opened simultaneously with the car-door. If desired, the car-door may be provided on its outer side with a similar stud or projection, d^9, to be engaged by a lever, d^{10}, pivoted to the said car, (see Fig. 11,) the said lever being acted upon by buttons d^{21}, secured to the wall of the elevator-shaft. When the car-door is thus provided on the outside with the locking device, as described, the holding device and the door-locking device inside the car may, if desired, be dispensed with.

The blocks a^8 a^9, herein shown in Fig. 2, may be omitted, and the guide and cam placed on the doors, especially when the space between the outside of the car and the inside of the well is but little.

We do not desire to limit ourselves to the precise form or construction of the holding device shown and described, as it is evident that the same may be changed to engage a wheel or a lever when applied to elevators employing these forms of operating mechanism.

In some cases it may be desired to start the elevator from the outside when a constant attendant is not employed—as, for instance, in a private dwelling—and in this case the shaft or car doors are provided with holes f f', substantially in line with each other, and, preferably, opposite the lever of the operating mechanism, so that the same may be reached and operated from the outside.

The hole f in the shaft-door may be provided with a cover which may be locked or secured in any desired manner to prevent tampering by unauthorized persons.

It will be noticed that the clamp to engage the starting mechanism and the bolt to lock the door are connected together, so that when one, as the clamp, is in operation the other is not and cannot be put in operation until the clamp is rendered inoperative, the movement made to render the clamp inoperative rendering the bolt operative.

We claim—

1. In an elevator, the combination, with a car having a door and a shipping mechanism within the car, of a clamp or holder to engage the shipping mechanism, and a bolt connected to the said clamp or holder to operate simultaneously therewith, and adapted to lock the car-door when the shipping mechanism is free to be operated to put the car in motion and to unlock said door when the shipping mechanism is clamped, substantially as described.

2. An elevator comprising a shaft-door, an elevator-car provided with a door, a shipping mechanism within the car, a clamp or holder to engage the shipping mechanism, a bolt connected to the said clamp or holder to operate simultaneously therewith and adapted to lock the car-door when the shipping mechanism is free to be operated to put the car in motion, and to unlock said door when the shipping mechanism is clamped, a door-connection, substantially as described, to lock the car-door and shaft-door together when the car-door is substantially opposite the shaft-door,

a locking device to lock said shaft-door, and projection carried by the car to operate said locking device to permit the shaft-door to be opened when the car-door is substantially opposite the shaft-door, substantially as described.

3. In an elevator, a car-door, a^3, having guides supported at its outer side combined with a door of the elevator shaft or well provided with a stud or projection to co-operate with said guides to open the said doors when the car-door is substantially opposite the shaft-door, substantially as described

4. In an elevator, a car-door, a^3, and a shaft-door, B, combined with a locking device or door-connection, consisting of guides a^4 a^5, and a stud to engage said guides to unite the said doors together when substantially opposite each other, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WILLIAM B. CABOT.
RICHARDS M. BRADLEY

Witnesses:
JAMES H. CHURCHILL,
B. DEWAR.

(No Model.) 2 Sheets—Sheet 1.

W. E. NICKERSON.

DEVICE FOR OPERATING ELEVATOR DOORS.

No. 408,509. Patented Aug. 6, 1889.

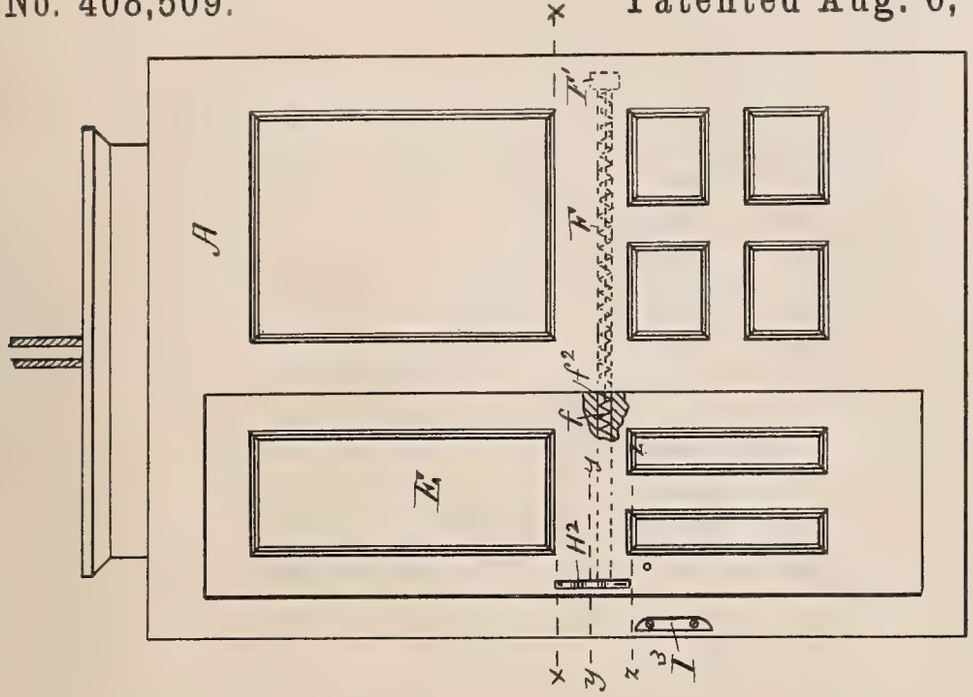


Fig. 2.

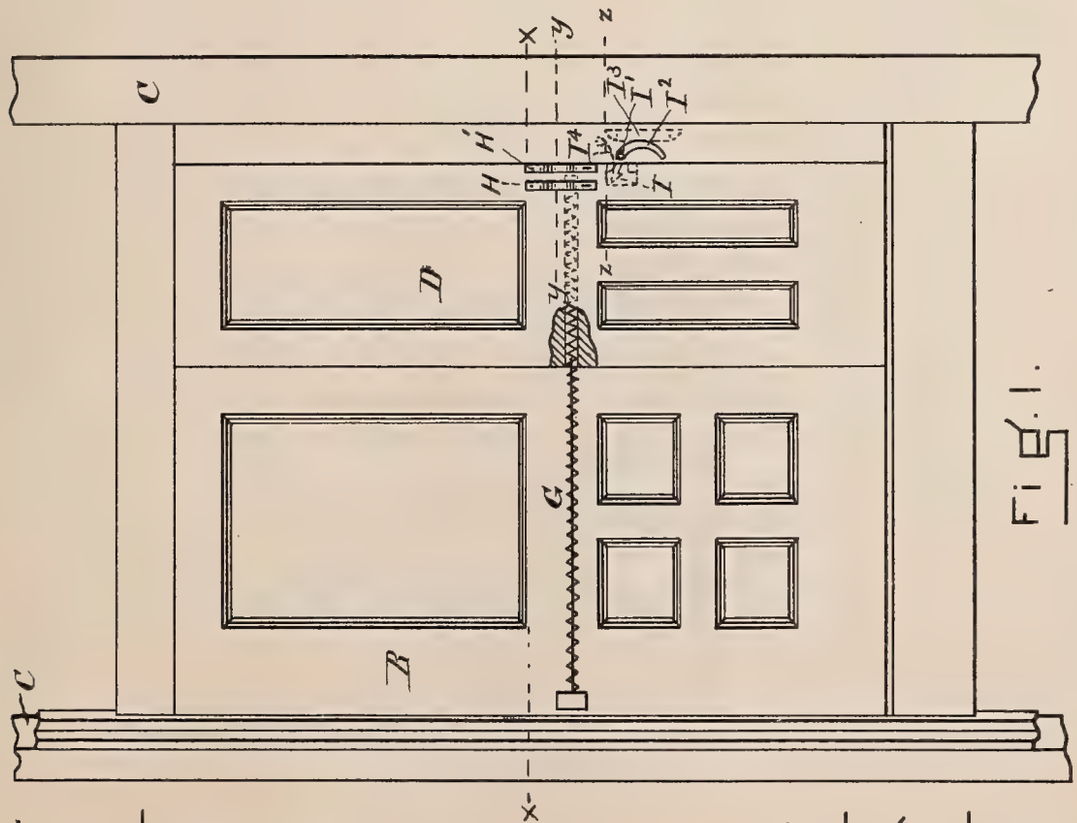


Fig. 1.

WITNESSES

Frank G. Parker

Matthew M. Blunt

INVENTOR

William E. Nickerson

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

W. E. NICKERSON.

DEVICE FOR OPERATING ELEVATOR DOORS.

No. 408,509. Patented Aug. 6, 1889.

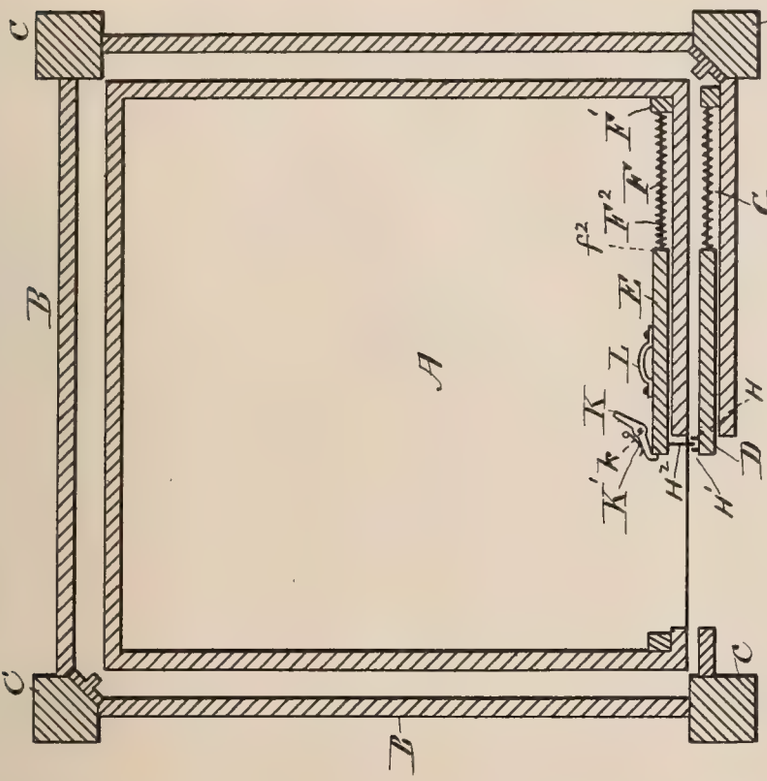


Fig. 4.

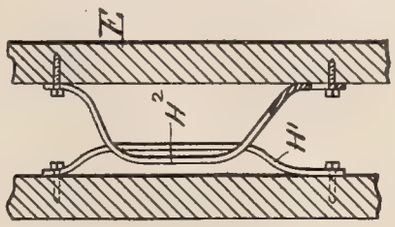


Fig. 7.

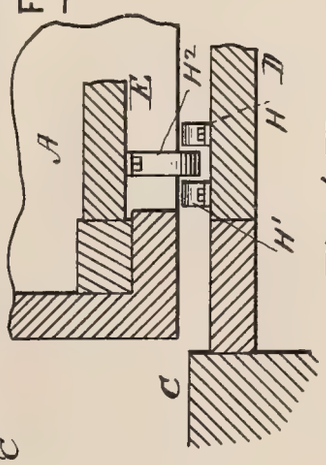


Fig. 6.

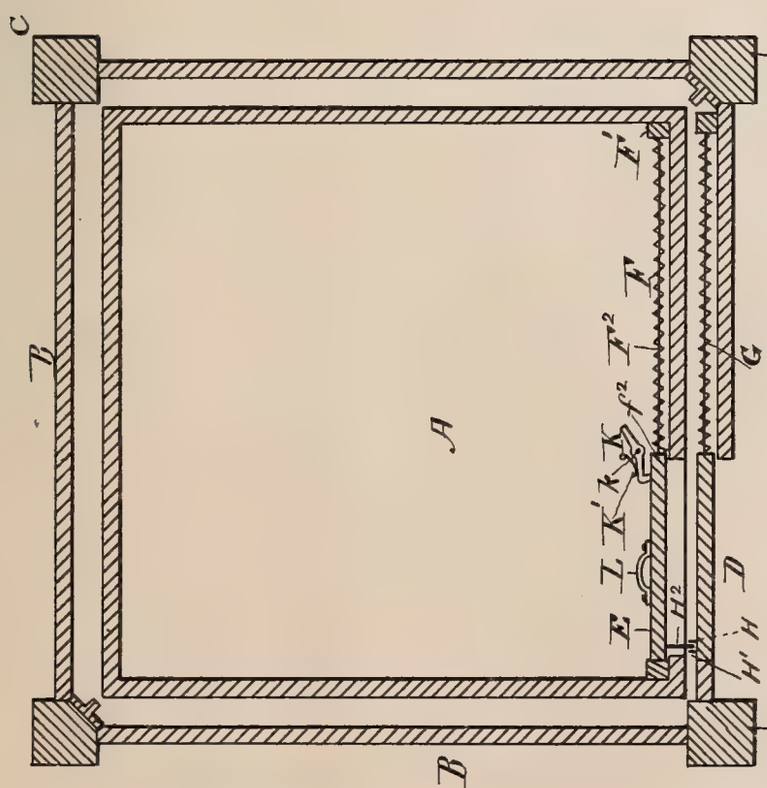


Fig. 5.

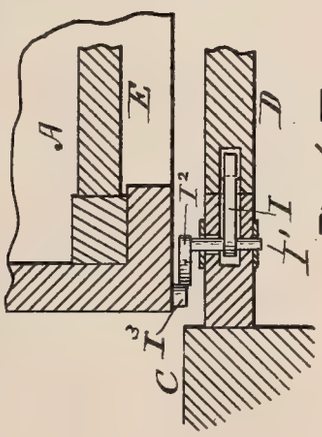


Fig. 5.

WITNESSES.

Frank G. Parker.

Matthew M. Blunt.

INVENTOR.

William E. Nickerson

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM E. NICKERSON, OF CAMBRIDGE, MASSACHUSETTS.

DEVICE FOR OPERATING ELEVATOR-DOORS.

SPECIFICATION forming part of Letters Patent No. 408,509, dated August 6, 1889.

Application filed May 1, 1889. Serial No. 309,182. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM E. NICKERSON, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Devices for Jointly Operating the Doors of the Elevator Carriage and Well-Room, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to elevator-doors, and has for its object the lessening of labor on the part of the attendant in opening and closing the same.

It consists in applying mechanisms to the doors of an elevator well-room and to the door of the carriage in such a manner that the door of the well-room at which the carriage is stopping and the carriage-door are simultaneously operated in opening and closing.

I have shown one method of reducing my invention to practice in the accompanying drawings, in which—

Figure 1 is an elevation showing a well-room door in its closed position and a part of the well-room wall, the point of view being within the well-room. Fig. 2 is an elevation of the side of the carriage, showing the door of the same as seen from the landing outside the carriage, no well-room door or wall being shown. Fig. 3 is a horizontal section of the carriage and well-room, (the carriage being at a landing,) taken on a level with the lines *x x*, Figs. 1 and 2, both the carriage-door and that of the well-room being closed. Fig. 4 is a horizontal section similar to Fig. 3, with the exception that both the doors are open instead of closed. Fig. 5 is a horizontal section of a portion of the carriage and well-room, enlarged, taken on the line *z z*, Figs. 1 and 2, and shows the construction of a detail. Fig. 6 is a horizontal section of a portion of the carriage and well-room, enlarged, taken on the line *y y*, Figs. 1 and 2, and shows the construction of a detail. Fig. 7 is a vertical section, enlarged, of portions of the carriage-door and of one of the well-room doors, and shows a detail.

A, Figs. 2, 3, 4, 5, and 6, indicates an elevator-carriage; B, Figs. 1, 3, and 4, the well-room walls, and C the corner-posts of the well-room.

D, Figs. 1, 3, 4, 5, 6, and 7, indicates a door of the well-room, and E, Figs. 2, 3, 4, 5, 6, and 7, the door of the carriage. The carriage-door E is provided with an openly-wound helical spring F. (Shown in Figs 3 and 4 and by dotted lines in Fig. 2.) Part of this spring occupies a cylindrical channel in the body of the door, as shown at *f*, Fig. 2, and the remainder of its extends along the side of the carriage to the block F′, which opposes its further extension at that end. A rod F^2 is situated within the helical spring extending from the block F′, to which it is fastened, to the point indicated by f^2 in the channel just within the edge of the closed door, Figs. 2 and 3, and serves to keep that part of the spring which is without the channel from lateral buckling, the channel itself performing the same office for that part of the spring which is within it. The function of the spring F is to close the door E when unrestrained, which it does by the tension which the opening of the door places upon it by compressing it.

The well-room door D is provided with a spring G, Figs. 1, 3, and 4, in all respects similar to spring F, and which serves to close the door D when unrestrained.

H and H′ are two spring-cleats upon the well-room door D, between which a similar spring-cleat H^2 on the carriage-door E passes in the ascent or descent of the carriage. (See Figs. 1, 2, 3, 4, and 6.) A side elevation of these spring-cleats enlarged is represented in Fig. 7, portion of the doors being shown. When the carriage stops at a landing, these cleats will stand relatively to each other, as shown in Figs. 6 and 7, and it is readily seen that if either door is moved laterally to open or shut it the other must move in unison with it. These cleats are made, preferably, in the shape of a flat spring, so as to yield readily to frontal but to resist lateral pressure, and each is bolted tightly at one end and held at the other by a bolt loosely set, the end of the cleat being slotted.

I, Figs. 1 and 5, is a latch in the well-room casing, adapted to engage the slot in the edge of the well-room door D to prevent the door from being opened from without. The latch I swings upon the pin I′, upon the inner end of which is placed a curved arm I^2, (see Figs.

1 and 5,) which engages with the block I^3, located on the carriage, (shown in Figs. 2 and 5, and whose location relative to the curved arm I^2 is shown by the dotted lines in Fig. 1,) and thereby raises the latch when the elevator is at the landing, allowing the door to be opened. The latch I is kept down when not held up by the block I^3 by a small spring, (shown at I^4, Fig. 1.)

K is a catch pivoted at *k* on the floor of the carriage for the purpose of holding the doors open when desired, and is kept in position by the spring K′.

L, Figs. 3 and 4, is a handle for moving the door E.

The operation of my invention is as follows: If the well-room doors are not automatic, but are operated manually, then the carriage-door E is moved by the hand of the attendant, and the well-room door D will, through the action of the cleats H, H′, and H^2, move in unison with it, (the carriage being at the landing, and the latch I consequently released.) If the carriage starts up or down from a landing, the doors not having been closed, then the cleats on the two doors will slip out of engagement, and the well-room door D will be closed by the spring G and locked by the latch I. If the well-room door is an automatic door moved by force derived from the movement of the car, as shown in my application dated March 3, 1889, Serial No. 304,521, subject, "elevator well-room doors," or otherwise, then it will control the movement of the carriage-door, and the actuating mechanism will cause both the well-room and the carriage-doors to open and close instead of the well-room door only.

If the well-room door is automatic, the cleat H may be dispensed with and the spring F be relied on to close the carriage-door; or the cleat H may be retained and the spring F omitted by making the spring G sufficiently stiff to close both doors. When the well-room door D is not automatic, but is moved by the attendant through the carriage-door E, then the cleat H′ may be omitted and the spring G depended upon to close the door D. If desired, the springs F and G may both be omitted and the door E operated wholly by hand, the door D moving in unison with it when the carriage is at a landing by means of the cleats H H′ H^2.

The gist of my invention consists in causing a well-room door to operate a carriage-door, or vice versa, by means of engaging cleats or equivalent mechanisms.

I claim as my invention—

1. In an elevator, the carriage A, its door E, the well-room door D, the spring G, and cleats H H′ H^2, substantially as and for the purpose set forth.

2. In an elevator, the carriage A, its door E, the well-room door D, the spring F, the spring G, and the cleats H, H′, and H^2, substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 29th day of April, A. D. 1889.

WILLIAM E. NICKERSON.

Witnesses:
FRANK G. PARKER,
MATTHEW M. BLUNT.

(No Model.) 3 Sheets—Sheet 1

C. E. ONGLEY.

ELECTRICALLY CONTROLLED ELEVATOR.

No. 410,180. Patented Sept. 3, 1889.

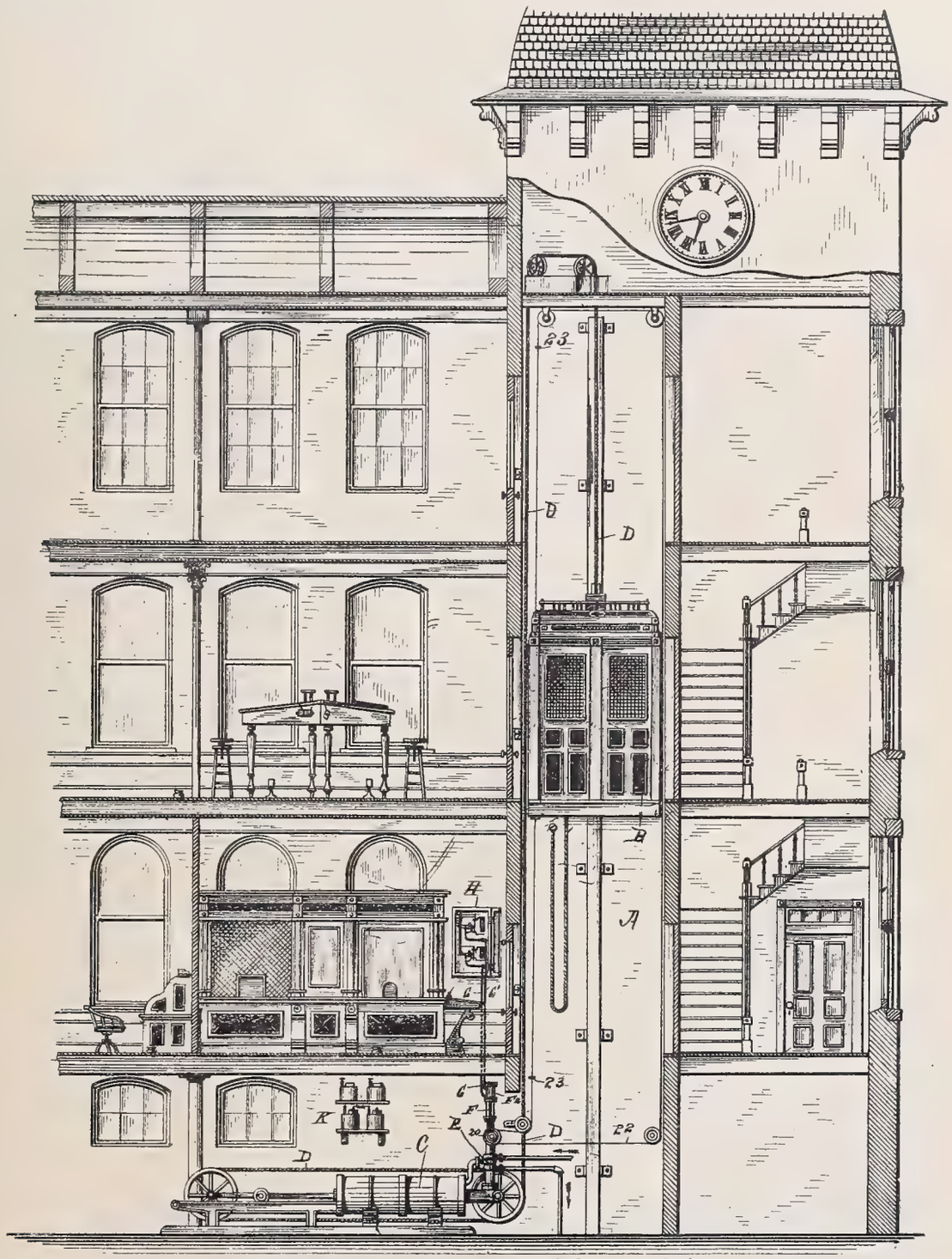


Fig. 1.

Witnesses
George H. Bott
O. H. Palmer

Inventor
Charles E. Ongley
by his Attorneys
Philipp Phelps & Hovey

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

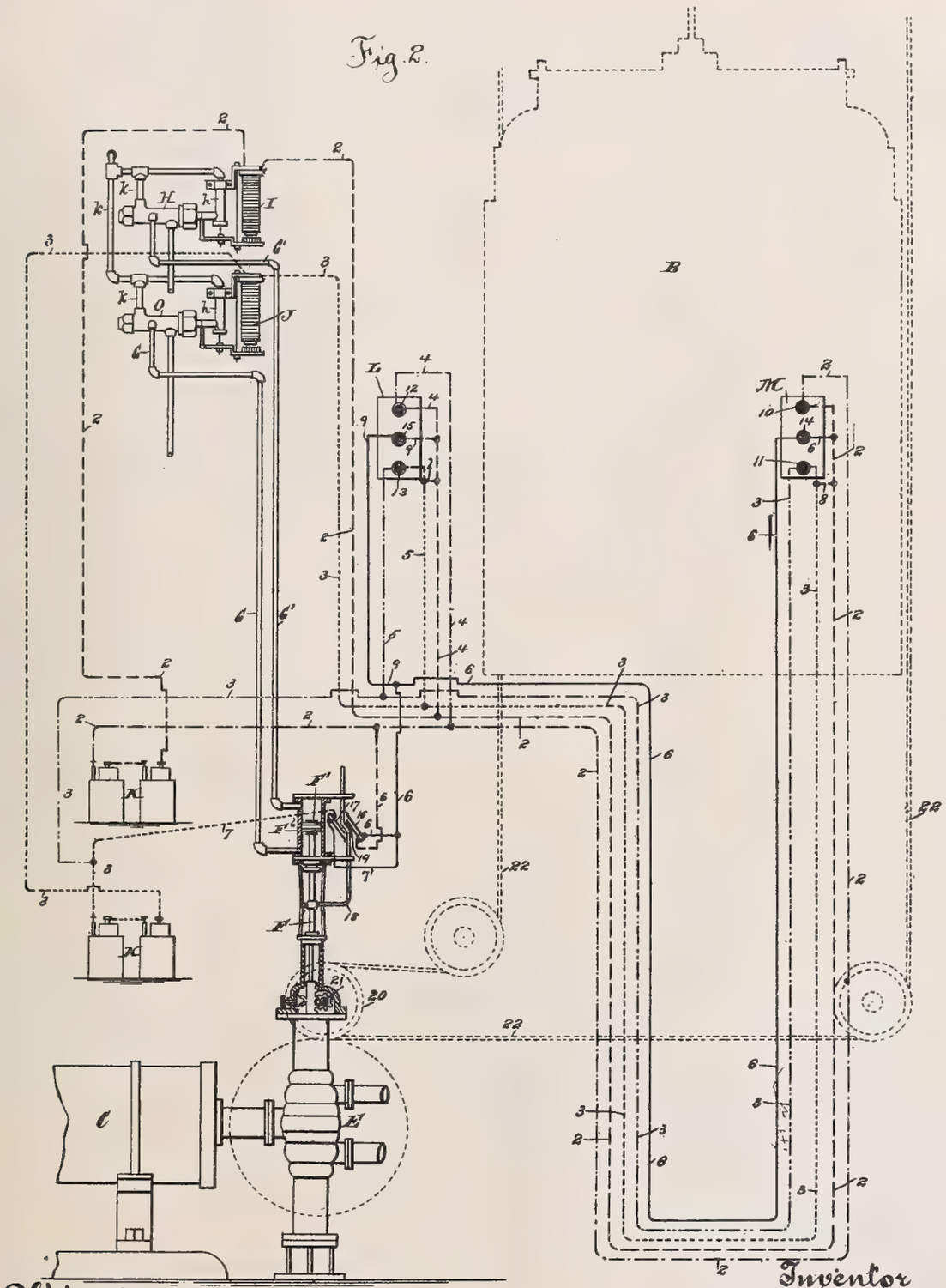
(No Model.) 3 Sheets—Sheet 2.

C. E. ONGLEY.

ELECTRICALLY CONTROLLED ELEVATOR.

No. 410,180. Patented Sept. 3, 1889.

Fig. 2.



Witnesses
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J. H. Palmer

Inventor
Charles E. Ongley
By his Attorneys
Philipp Phelps & Hovey

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 3.

C. E. ONGLEY.

ELECTRICALLY CONTROLLED ELEVATOR.

No. 410,180. Patented Sept. 3, 1889.

Fig. 3.

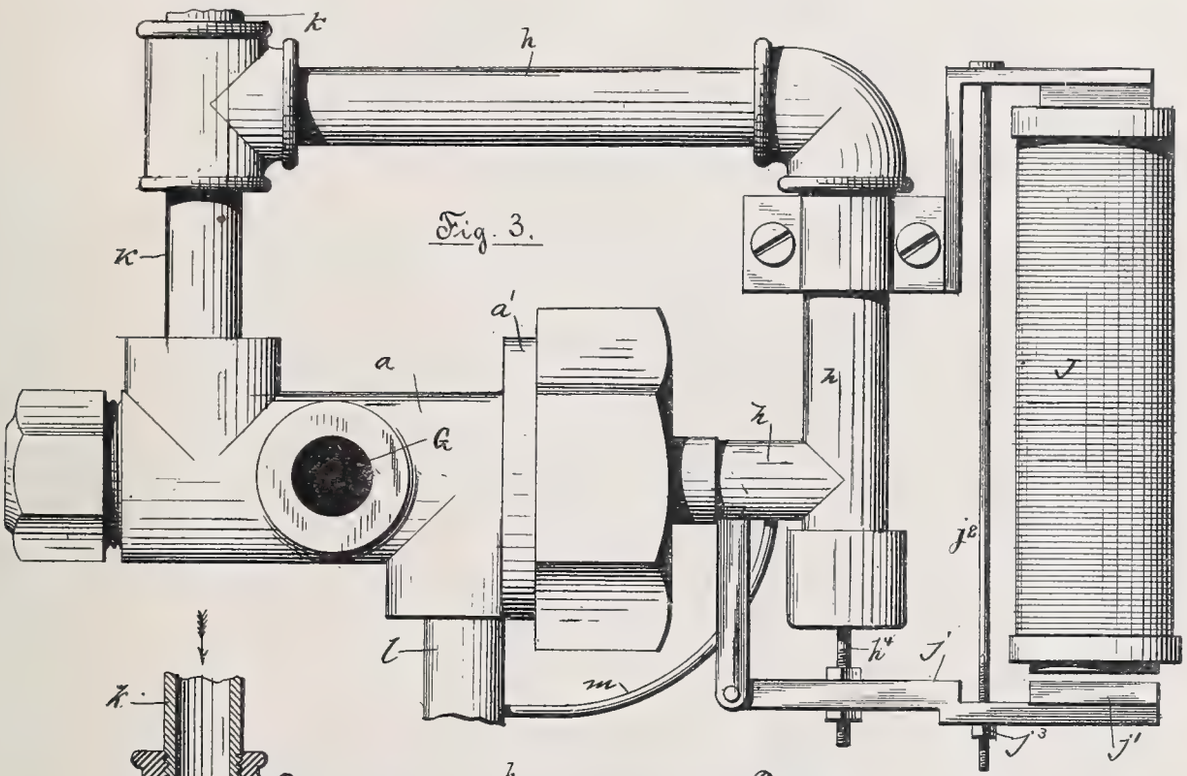
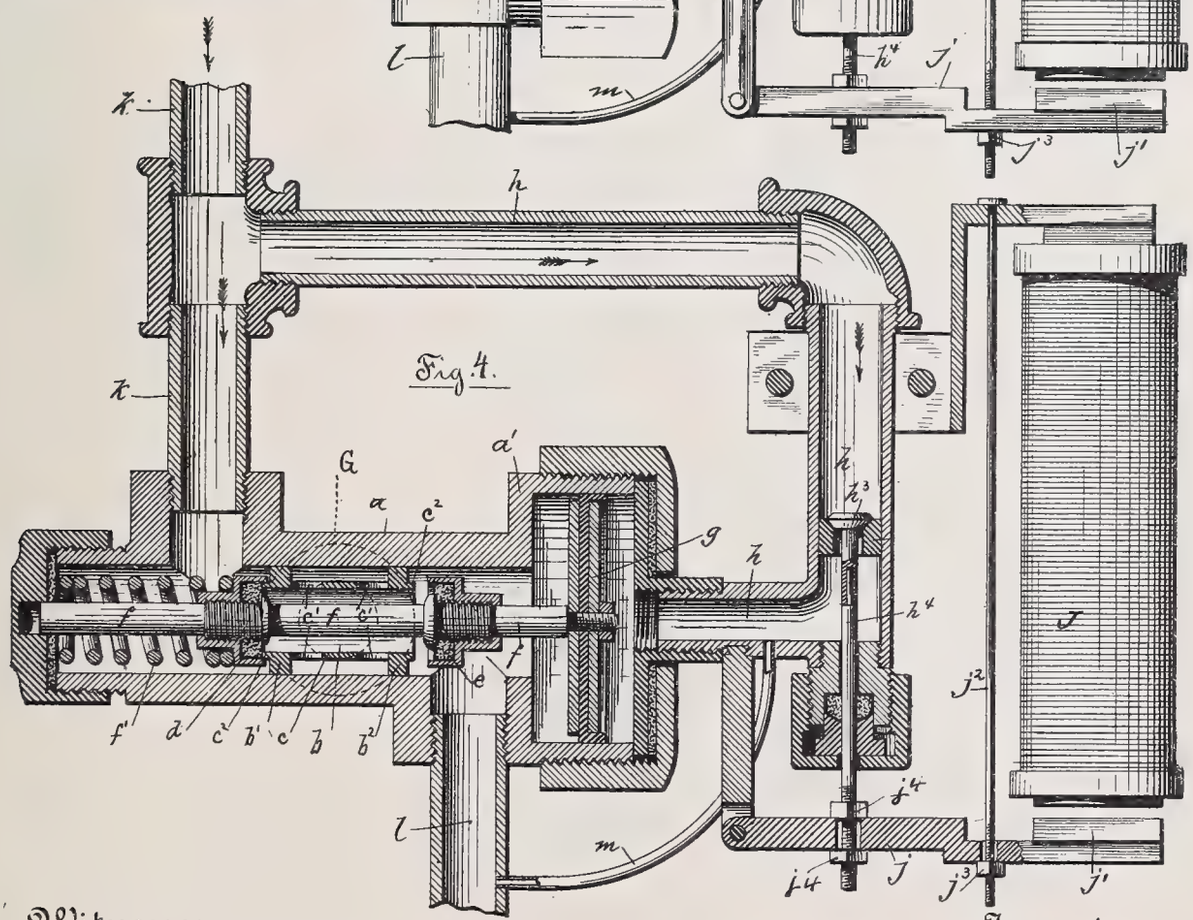


Fig. 4.



Witnesses
George H. Botts
J. H. Palmer

Inventor
Charles E. Ongley

By his Attorneys
Philipp Phelps & Hovey

THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES E. ONGLEY, OF NEW YORK, N. Y., ASSIGNOR TO THE HYDRAULIC ELEVATOR COMPANY, OF ILLINOIS.

ELECTRICALLY-CONTROLLED ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 410,180, dated September 3, 1889.

Application filed November 22, 1887. Serial No. 255,857. (No model.)

To all whom it may concern:.

Be it known that I, CHARLES E. ONGLEY, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in Elevators, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to an organized apparatus for operating electrically the main-valve or other mechanism which controls the movements of an elevator.

The invention consists, broadly, in an organized system of electrical connections by which the elevator, having been stopped at any point, will be prevented from starting in the opposite direction; of an organization which combines with electrical appliances for actuating the controlling mechanism of the elevator a means by which said mechanism can be operated mechanically from the car in case of an emergency, and of a novel form of auxiliary-valve apparatus combined with electrical connections for actuating the main-valve or other controlling mechanism of the elevator.

In the accompanying drawings, Figure 1 shows in sectional view a portion of a building containing an elevator equipped according to my invention, showing the relation of the several parts. Fig. 2 is a diagram illustrating the several electric circuits and the means by which the movements of the elevator are controlled through said circuits either from the car or any portion of the building. Fig. 3 is an enlarged elevation of the auxiliary-valve apparatus and its electromotor by which the main-valve or other controlling mechanism of the elevator is moved in one direction. Fig. 4 is a sectional view of the same.

Referring to said drawings, A denotes an elevator-shaft, B the car, C a hydraulic cylinder or other motor by which the car B is raised, and D the hoisting-cable, all of which parts are organized in the usual and well-known manner.

E represents the mechanism for controlling the movements of the elevator, which in the case shown is the main or induction and exhaust valve of the cylinder C, and is of any suitable construction to allow the water to be admitted to the cylinder C to cause the car to ascend when the valve is in one position, to allow the water to escape from the cylinder to permit the car to descend when the valve is reversed, and to close both the induction and exhaust to stop the car when the valve is in an intermediate or mid position. Such cylinders and valves are in common use, and their construction is well known. I have not, therefore, deemed it necessary to illustrate or describe the same in detail. It is to be understood, however, that the cylinder C may, if preferred, be arranged vertically instead of horizontally and may be provided with the well-known circulating-pipe, or may be a motor of any of the forms common in elevators. The mechanism for controlling the movements of the elevator-car is therefore the main valve or other mechanism which controls the movements of the elevator-motor, and this mechanism is determined by the character of the motor employed.

F′ is a piston, which works in a cylinder F^2, and is connected by a rod F to the main-valve or other controlling mechanism. The cylinder F^2 is provided with induction and exhaust pipes G G′, forming ports through which the water is allowed to flow into and out of the cylinder upon the opposite sides of the piston F′, moving it and the connected main valve upward or downward, as it is desired to cause the car to descend or ascend.

The pipes G G′ are controlled by means of what I term "auxiliary-valve mechanisms" H O, which are operated by electromotors under the control of the conductor or of a person at any landing. The electromotors are herein shown as ordinary electro-magnets and will be hereinafter termed "magnets;" but the term is to be understood as including any form of electromotor which can be energized by an electric current.

As the auxiliary-valve mechanisms H O are connected by the pipes G G′ with the valve-operating cylinder F^2, these mechanisms may be placed in any convenient position in any portion of the building, either near to or remote from the main valve of the elevator. In the drawings they are shown as inclosed in a

case attached to the wall upon the first story of the building, while the elevator-operating mechanism with its main valve are located in the basement.

The valve mechanisms H O are alike in construction and operation and have, for convenience, a common water-supply, one valve controlling the pipe G and the other the pipe G′. These valves are controlled by electro-magnets I J, which are energized through electric circuits, which include batteries K and appropriate circuit-closers L M, located at the different landings and on the car.

The construction and operation of the auxiary-valve mechanisms H O will now be described. As these two mechanisms are exact duplicates, a description of one will apply to both.

Referring to Figs. 3 and 4, it is to be understood that a is a valve-cylinder containing two valve-seats c^2, formed upon the ends of a bushing b, having perforations c' and two heads b' b^2, which are securely fastened in the cylinder. The auxiliary induction and exhaust valves d e are connected by a valve-rod f, to which a spiral spring f' is applied to hold the valve d against its seat and the valve e away from its seat. The valve-cylinder is enlarged at one end to form a cylinder a', in which is fitted a piston g, which is attached to the valve-rod f.

Communicating with the cylinder a' is a pipe h, which is controlled by a valve h^3, termed, for convenience, a "primary" valve, the rod h^4 of which is adjustably connected by the nuts j^4 to a lever j, carrying at its free end an armature j', held within the magnetic field of the electro-magnet J by means of the suspension-rod j^2, having a nut j^3, by which the position of the lever j is adjusted. The water-supply pipe k communicates with the valve-cylinder a and also with the pipe h, as shown, and the induction and exhaust pipes G G′ communicate with the cylinders a of the respective valve mechanisms between the heads b' b^2 of the bushing b. Each of the cylinders a is provided with waste-pipe l, which communicates with the space between the valve e and piston g, and each of the pipes h is provided with a small open waste-pipe m, which communicates with the pipe between the piston g and valve h^3.

The operation is as follows: The valves d are normally held against their seats c^2, and the valves e away from the seats by the springs f' and also by the pressure of the water in the supply-pipe k, thereby preventing any water from entering the pipes G or G′ to act upon the piston F′ and operate the main valve, and at the same time allowing the water to flow out of the cylinder upon both sides of the piston to permit the piston to be moved in either direction. As soon, however, as either one of the magnets I or J is energized by the closing of the electric circuit through said magnet, its armature will be attracted, thus raising the lever j and primary valve h^3, and allowing water from the pipe h to enter the cylinder a' and act upon the piston g, and as the area of the piston g exceeds that of the auxiliary induction-valve d, the valve e will be moved to its seat and the valve d away from its seat, and allow the water to enter by the valve d and pass through the openings c' to the pipe G or G′, as the case may be, and to the cylinder F^2, causing the piston F′ to be moved and operate the main valve to cause the car to ascend or descend. As soon as the circuit through the magnet is broken, the magnet will be de-energized and its armature released. The weight of the lever j, aided by the pressure of the water in the pipe h, will at once close the primary valve h^3, thereby removing the pressure from the piston g. The water between the valve h^3 and the piston g will then gradually escape through the pipe m, thereby allowing the spring f' to close the auxiliary induction-valve d, so as to shut off the further flow of water to the cylinder F^2, and at the same time the auxiliary exhaust-valve e will be opened to allow the water contained in the pipe G or G′, as the case may be, and in the end of the cylinder F^2, with which that pipe communicates, to pass freely into the waste-pipe l. By closing the circuit through the other magnet the same operation will take place in the other auxiliary-valve apparatus, thereby admitting water to the other end of the cylinder F^2 to act upon the opposite side of the piston F′ and move the main valve in the opposite direction, and this being continued the main valve will be reversed and the car caused to move in the opposite direction; or, if it is desired to simply stop the car, the circuit will be broken as soon as the main valve arrives in its mid position, and the car will then remain at rest. As the piston F′ is moved in either direction, by the admission of water to one end of the cylinder F^2 the water in the other end of the cylinder will find an unobstructed escape through the pipe G or G′, as the case may be, and past the auxiliary exhaust-valve e to the waste-pipe l. The waste-pipes m are, as will be observed, always open for the escape of water from the cylinder a'; but these pipes being of small size as compared with the pipes h, the water will not escape with sufficient rapidity to prevent the pistons g from operating properly. The rods h^4 of the primary valves h^3 are preferably provided with sliding joints, as shown in Fig. 4, so as to permit those valves to accommodate themselves more readily to their seats.

The system of electrical connections by which the magnets I J are energized to operate the primary valves h^3 to control the movements of the elevator-car, as just described, will now be explained. In this explanation it will be assumed that the auxiliary-valve apparatus H, which is operated by the magnet I, controls the ascent of the car, and that the auxiliary-valve apparatus O, which is operated by the magnet J, controls the descent

of the car. In the organization herein shown the two magnets are energized by separate batteries K. This is preferable, but is not in all cases necessary, as in some cases a single battery may be employed for both magnets. The magnet I is located in an electric circuit formed of wires or electrical conductors 2, which circuit includes one of the two batteries K and a push-button or other circuit-closer 10, located upon the car B. The course of this circuit, and also of the other circuits to be referred to, can readily be traced by reference to Fig. 2 of the drawings. The term "push-button" is herein used for convenience, and is to be understood as including any means for making and breaking the circuits. The magnet J is located in a similarly-arranged circuit 3, which includes the other one of the two batteries K and a push-button or other circuit-closer 11, also located upon the car.

From the description of the operation of the auxiliary-valve apparatus which has already been given, it will readily be seen that by operating the button 10 to close the circuit 2 and energizing the magnet I the car will be caused to ascend, and that by releasing said button 10, so as to break the circuit 2 and de-energize the magnet I and then operating the button 11 to close the circuit 3 and energize the magnet J, the car will be stopped or caused to descend, according to the length of time the circuit 3 is kept closed, and vice versa.

There are many cases where it is desirable, in addition to the means for controlling the movements of the elevator from within the car, that there should also be provided means by which a person at any landing can cause the car to ascend or descend to that landing. To enable this to be accomplished, the circuits 2 3 are respectively provided with branch circuits or loops 4 5, which include push-buttons or other circuit-closers 12 13, located at each landing, as also indicated in Fig. 2. By this means a person at any landing can, by operating the button 12 or 13, cause the car to ascend or descend, as the case may be, to that landing, and can then arrest the car by operating the other button in the same manner as already described in connection with the buttons upon the car.

The push-buttons of only one landing are indicated in the drawings; but it will readily be understood that the buttons at any number of landings can be arranged and connected to the circuits 2 3 in the same manner.

From what has been said it will be seen that the two circuits 2 3, with their respective branches 4 5, are sufficient to enable a person either in the car or at any landing to cause the car to ascend and descend and come to rest at any desired point. In order, however, to bring the car to rest and retain it at any point, it is necessary, as has been explained, to break the circuit as soon as the car stops, as if the circuit continues closed after the car has stopped the main valve will move onward past its mid-position, and thus cause the car to start in the opposite direction from that in which it was moving before it stopped. If the person operating the elevator is skillful and attentive, this will occasion no special difficulty, because such a person will be able to break the circuit at the proper time to retain the car in whatever position it is stopped. With an unskillful or inattentive operator this, however, might occasion some trouble and annoyance, and it is therefore desirable to provide means by which, when it is desired to stop and retain the car in any position without reversing its movement, the circuit will be automatically broken at the proper time to effect this result. For this purpose the circuit 2, which includes the magnet I and one of the batteries K, is provided with a branch circuit 6, which includes a push-button or circuit-closer 14, located upon the car, and also a pair of spring-contact plates or brushes 16. This branch 6 is in turn provided with a branch 7, which leaves the branch 6 between the button 14 and the brushes 16, and unites with the circuit 3 at a point between the battery K and the button 11. This branch 7 is also provided with a pair of brushes 17, similar to the brushes 16. The circuits 2 3 are also connected by a branch 8, which connects the two circuits at a point near the buttons 11 14. The brushes 16 17 are located adjacent to a rod 18, which is connected to the rod F of the piston F′, and reciprocates through guides secured to the sides of the cylinder F^2; or this rod may be similarly reciprocated by some other moving part of the mechanism. This rod is provided with oppositely-inclined shoulders 19, forming a circuit-closer, which is so arranged that when the main valve is in its mid-position, so as to stop the car, the circuits through the branches 6 7 will both be broken. When, however, the valve is moved upward from its mid-position, so as to cause the car to descend, the brushes 16 will be acted upon by the circuit-closer 19, so as to be brought together, thereby closing the circuit through the branch 6, which circuit will then remain closed until the valve is moved back to its mid-position. As the valve is moved downward from its mid-position, so as to cause the car to ascend, the brushes 17 will be operated in the same manner to close the circuit through the branch 7, which circuit will remain closed until the valve is again moved back to its mid-position. It will readily be seen, however, that as soon as the valve, moving in either direction, arrives at its mid-position the circuits through both of the branches 6 7 will be automatically broken.

Assuming now that the main valve has been moved downward from its mid-position, so as to cause the car to ascend, and at the same time close the circuit through the branch 7, it is only necessary in order to stop and retain the car at any point to press the button

14. The circuit will then be completed from the button, through the wires 6 7 3, to the battery K, and from the battery, through the wires 3, to the magnet J, and from the magnet, through the wires 3 8 2 6, to the button. This will energize the magnet J and cause the main valve to ascend until it arrives at its mid-position, when the circuit through the branch 7 will be automatically broken, thereby de-energizing the magnet and preventing the main valve from being moved upward past its mid-position, so as to reverse the monement of the car, and this will be the case whether the attendant breaks the circuit by releasing the button 14 or not. If the main valve has been moved upward from its mid-position, so as to cause the car to descend, the operation of stopping and retaining the car will be the same, except that in this case the circuit will be closed through the branch 6, so that upon pressing the button 14 the circuit will be completed from the button, through the wires 6 2, to the other battery K, and from the battery, through the wire 2, to the magnet I, and from the magnet, through the wires 2 6, to the button, thereby energizing the magnet I and causing the main valve to move downward until it arrives at its mid-position. To enable the same operation to be performed from any landing, it is only necessary to provide the branches 4 with branches 9, which connect with the branch 6, and in which are located push-buttons 15 at each landing, and to connect the branches 4 5, as indicated at 1.

In addition to the electrical appliances which have been described for actuating the controlling mechanism in the ordinary working movements of the elevator, it is desirable that means should be provided by which, in case of an accident, or in case the electrical appliances should, for any reason, become ineffective, the conductor can have control of the main valve or other controlling mechanism by means of mechanical connections. For this purpose the rod F is provided with the usual rack, which is engaged by a pinion upon a shaft 21, having a pulley 20, around which passes a hand-rope 22, which extends around pulleys located at the top and bottom of the shaft, and passes through the car in the usual manner.

It has been already stated that the auxiliary induction and exhaust valves *d e* are normally maintained in such position as to afford an unobstructed escape for the water from both sides of the piston F′. From this it results that in case the electrical connections or the auxiliary-valve mechanisms fail to act, the main valve will not be locked by the water in the cylinder F^2, but will be free to be operated by the hand-rope 22, or other mechanical connection. This hand-rope will not be used in the ordinary working of the elevator by the electrical appliances; but in case of any emergency, as before stated, the conductor can by means of this hand-rope operate the main valve and thus have mechanical control of the movements of the elevator, as in the old way. The hand-rope 22 may be provided with the usual buttons 23, (see Fig. 1,) located near the top and bottom of the shaft, and which will engage with the car and operate the main valve to stop the car before it reaches the limit of its movement in either direction. The ordinary hand-rope is herein illustrated as the simplest and, all things considered, the most desirable mechanical appliance for operating the main valve in connection with the electrical appliances herein described; but it is to be understood that any of the other forms of mechanical connections by which the conductor in the car is enabled to control the main valve may be applied and used in place of the simple hand-rope shown, and are to be regarded in this connection as the equivalent of said rope.

The form of motor C for operating the elevator which is herein shown, has been selected merely for the purpose of illustrating the application of the invention. Any other suitable form of motor may of course be employed.

What I claim is—

1. The combination, with an elevator-car and the mechanism for controlling its movements, of an electro-magnet for actuating said controlling mechanism, a circuit-closer 14 or 15, in circuit with said magnet, and a circuit-closer 19, operated by a moving part of the elevator mechanism to close the circuit through said magnet when the car is in motion and to break the circuit through said magnet when the car is at rest, substantially as described.

2. The combination, with an elevator-car and the mechanism for controlling its movements, of electro-magnets I J, for actuating said controlling mechanism to cause the car to move in opposite directions, a circuit-closer 14 on the car, which is in circuit with both of said magnets, and a circuit-closer 19, operated by a moving part of the elevator mechanism to close the circuit through one of said magnets when the car is in motion and to break the circuits through both of said magnets when the car is at rest, substantially as described.

3. The combination, with an elevator-car and the mechanism for controlling its movements, of electro-magnets I J, for actuating said controlling mechanism to cause the car to move in opposite directions, circuit-closers 15, located at the landings and in circuit with both of said magnets, a circuit-closer 19, operated by a moving part of the elevator mechanism to close the circuit through one of said magnets when the car is in motion and to break the circuits through both of said magnets when the car is at rest, substantially as described.

4. The combination, with an elevator-car and mechanism for controlling its movements, of electro-magnets I J, for actuating said controlling mechanism to cause the car to move

in opposite directions, circuit-closers 10 11 upon the car, one of which is in circuit with each magnet, a third circuit-closer 14, which is in circuit with both of said magnets, and a circuit-closer 19, operated by a moving part of the elevator mechanism to close the circuit through one of said magnets when the car is in motion and to break the circuits through both of said magnets when the car is at rest, substantially as described.

5. The combination, with the mechanism for controlling the movements of an elevator, of the cylinder F^2, and piston F', for actuating said mechanism, an auxiliary-valve apparatus controlling said piston and normally maintained in an open position to allow the water to flow out of the cylinder from either side of the piston, an electro-magnet for actuating said auxiliary-valve apparatus, an electric circuit including said magnet, and a circuit-closer upon the car, and a rope or its equivalent connected to operate said controlling mechanism from the elevator-car, substantially as described.

6. The combination, with the mechanism for controlling the movements of an elevator-car, of a cylinder and piston for actuating said mechanism, an auxiliary-valve apparatus controlling said piston and normally maintained in an open position to allow the water to flow out of the cylinder from either side of the piston, two electro-magnets for actuating said auxiliary-valve apparatus to cause the car to move in opposite directions, two electric circuits including said magnets and circuit-closers upon the car, and a rope or its equivalent connected to operate said controlling mechanism from the elevator-car, substantially as described.

7. The combination, with the mechanism for controlling the movements of an elevator-car, of a cylinder and piston for actuating said mechanism, an auxiliary-valve apparatus controlling said piston and normally maintained in an open position to allow the water to flow out of the cylinder from either side of the piston, two electro-magnets for actuating said auxiliary-valve apparatus to cause the car to move in opposite directions, two electric circuits including said magnets and circuit-closers upon the car, a rope connected to operate said controlling mechanism from the elevator-car, and stops 23 upon said rope arranged to be engaged by a moving part of the elevator before the car reaches the limit of its movement in either direction, substantially as described.

8. The combination, with the mechanism for controlling the movements of an elevator, of the cylinder F^2, and piston F', for actuating said mechanism, an auxiliary-valve apparatus controlling said piston and normally maintained in an open position to allow the water to flow out of said cylinder from both sides of said piston, an electro-magnet for actuating said auxiliary-valve apparatus, and an electric circuit including said magnet and a circuit-closer upon the car, substantially as described.

9. The combination, with the mechanism for controlling the movements of an elevator, of the cylinder F^2, and piston F', for actuating said mechanism, an auxiliary-valve apparatus for controlling said piston and normally maintained in an open position to allow the water to flow out of said cylinder from both sides of said piston, two electro-magnets for actuating said auxiliary-valve apparatus to cause the car to move in opposite directions, and two electric circuits including said magnets and circuit-closers upon the car, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES E. ONGLEY.

Witnesses:
J. J. KENNEDY,
GEORGE H. BOTTS.

(No Model.)

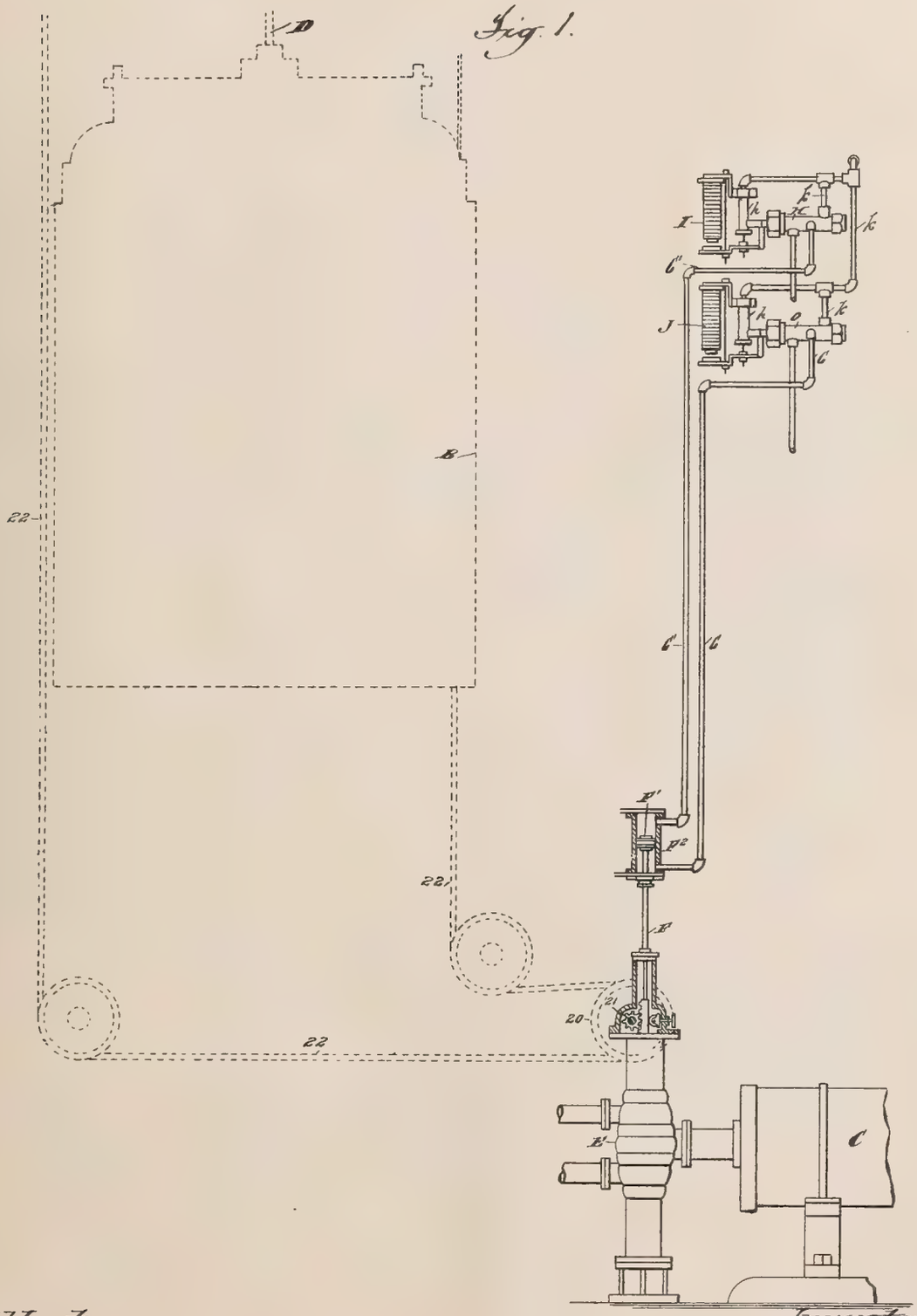
2 Sheets—Sheet 1.

C. E. ONGLEY.

ELEVATOR.

No. 410,181. Patented Sept. 3, 1889.

Fig. 1.



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N. PETERS. Photo-Lithographer. Washington. D. C.

(No Model.) 2 Sheets—Sheet 2.

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Fig 2.

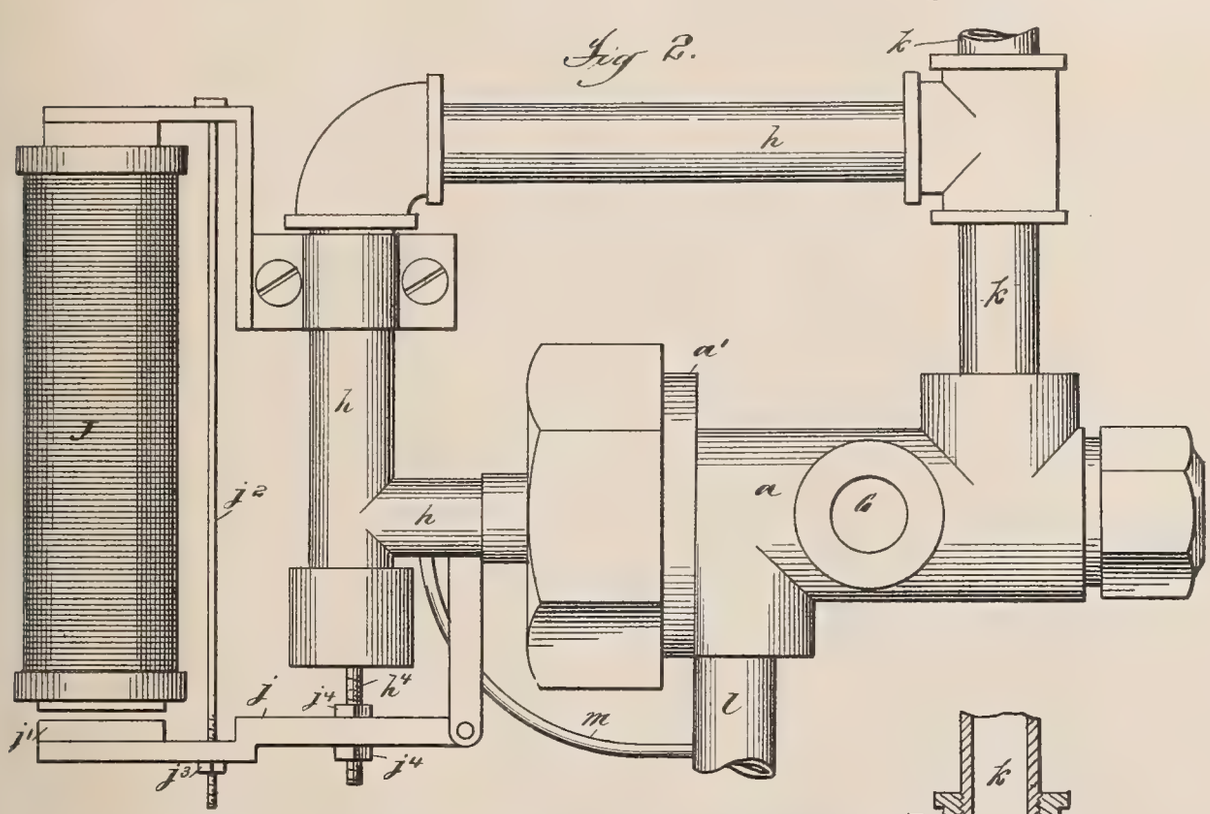
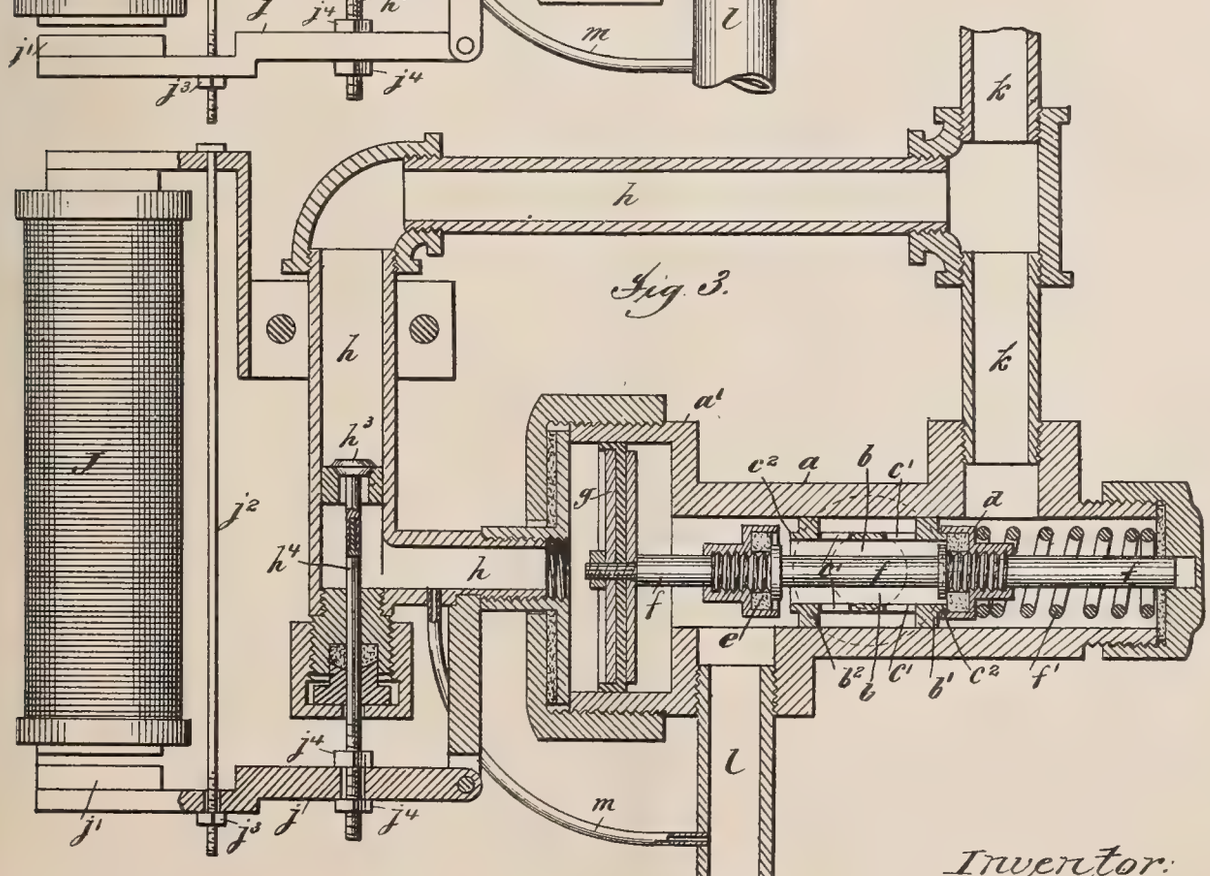


Fig 3.



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UNITED STATES PATENT OFFICE.

CHARLES E. ONGLEY, OF NEW YORK, N. Y., ASSIGNOR TO THE HYDRAULIC ELEVATOR COMPANY, OF ILLINOIS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 410,181, dated September 3, 1889.

Original application filed November 22, 1887, Serial No. 255,857. Divided and this application filed March 9, 1888. Serial No. 266,653. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. ONGLEY, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in Elevators, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to a mechanism for operating the main valve or other mechanism which controls the movements of an elevator, which is especially adapted for use in connection with a system of electrical connections for operating the same, such as or similar to that shown in my prior application for Letters Patent filed November 22, 1887, Serial No. 255,857, of which application the present is a division. The mechanism constituting the present invention may, however, be operated otherwise than electrically.

The invention consists, primarily, in what I term an "auxiliary-valve apparatus," by which the elevator-controlling mechanism is operated in the ordinary working of the elevator, but which is so constructed and organized as to permit the main valve or other controlling mechanism to be operated by other means in case of an emergency.

In the accompanying drawings, Figure 1 is a diagrammatic view illustrating an organization of the apparatus embodying the present invention. Fig. 2 is an enlarged elevation of what I term the "auxiliary-valve apparatus," by which the main valve is moved in one direction; and Fig. 3 is a sectional view of the same.

Referring to said drawings, it is to be understood that B represents an elevator-car, C a hydraulic cylinder or other motor by which the car is raised, and D the hoisting-cable, all of which parts are organized in the usual and well-known manner.

E represents the mechanism for controlling the movements of the elevator, which, in the case shown, is the main or induction and exhaust valve of the cylinder C, and is of any suitable construction to allow the water to be admitted to the cylinder to cause the car to ascend when the valve is in one position, to allow the water to escape from the cylinder to permit the car to descend when the valve is reversed, and to close both the induction and exhaust to stop the car when the valve is in an intermediate or mid position. Such cylinders and valves are in common use, and their construction is well known. I have not, therefore, deemed it necessary to illustrate or describe the same in detail. It is to be understood, however, that the cylinder C may, if preferred, be arranged vertically instead of horizontally, and may be provided with the well-known circulating-pipe, or may be a motor of any of the forms common in elevators. The mechanism for controlling the movements of the elevator is therefore the main valve or other mechanism which controls the movements of the elevator-motor, and will vary according to the character of the motor employed. The main valve or other controlling mechanism is connected to the rod F of a piston F′, which works in a cylinder F^2, connected to pipes G G′, forming ports, through which water under pressure flows into and out of the cylinder upon the opposite sides of the piston F′, thereby moving it and the connected main valve upward or downward, as it is desired to cause the car to descend or ascend. The pipes G G′ are controlled by means of auxiliary-valve mechanisms H O, which are operated, preferably, by electromotors under the control of the conductor in the car. As the auxiliary-valve mechanisms H O are connected by the pipes G G′ with the valve-operating cylinder F^2, these mechanisms may be placed in any convenient position in any portion of the building, either near to or remote from the main valve of the elevator.

The auxiliary-valve mechanisms H O are alike in construction and operation, and have for convenience a common water-supply, one apparatus controlling the pipe G and the other the pipe G′. These auxiliary-valve apparatuses are controlled in the case shown by electromotors I J, which are energized through electric circuits, including suitable battery power and appropriate circuit-closers, located upon the car and at the different landings, all as shown and described in my prior application before referred to.

The construction and operation of the auxiliary-valve mechanisms H O will now be described. As these two mechanisms are exact duplicates, a description of one will apply to both.

Referring to Figs. 2 and 3, it is to be understood that a is a valve-cylinder containing two valve-seats c^2, formed upon the ends of a bushing b, having perforations c' and two heads b' b^2, which are securely fastened in the cylinder. The auxiliary induction and exhaust valves d e are connected by a valve-rod f, to which a spiral spring f' is applied to hold the valve d against its seat and the valve e away from its seat. The valve-cylinder is enlarged at one end to form a cylinder a', in which is fitted a piston g, which is attached to the valve-rod f. Communicating with the cylinder a' is a pipe h, which is controlled by a valve h^3, termed for convenience a "primary valve," the rod h^4 of which is adjustably connected by the nuts j^4 to a lever j, carrying at its free end an armature j', held within the magnetic field of the electromotor J by means of the suspension-rod j^2, having a nut j^3, by which the position of the lever j is adjusted.

The water-supply pipe k communicates with the valve-cylinder a, and also with the pipe h, as shown, and the induction and exhaust pipes G G' communicate with the cylinders a of the respective valve mechanisms between the heads b' b^2 of the bushing b. Each of the cylinders a is provided with a waste-pipe l, which communicates with the space between the valve e and piston g, and each of the pipes h is provided with a small open waste-pipe m, which communicates with the pipe between the piston g and valve h^3.

The operation is as follows: The valves d are normally held against their seats c^2 and the valves e away from the seats by the springs f', and also by the pressure of the water in the supply-pipe k, thereby preventing any water from entering either of the pipes G or G' to create a greater pressure upon one side of the piston F' and operate the main valve and at the same time leaving the pipes G G' open to allow the water to flow out of either end of the cylinder F^2, and thus permit the piston F' to be moved in either direction. As soon, however, as either one of the motors I or J is energized by the closing of the electric circuit through said motor, its armature will be attracted, thus raising the lever j and primary or motor valve h^3 and allowing water from the pipe h to enter the cylinder a' and act upon the piston g, and as the area of the piston g exceeds that of the auxiliary induction-valve d the valve e will be moved to its seat and the valve d away from its seat and allow the water to enter by the valve d and pass through the openings c' to the pipe G or G', as the case may be, and to the cylinder F^2, causing the piston F' to be moved and operate the main valve to cause the car to ascend or descend. As soon as the circuit through the motor is broken the motor will be de-energized and its armature released. The weight of the lever j, aided by the pressure of the water in the pipe h, will at once close the primary valve h^3, thereby removing the pressure from the piston g. The water between the valve h^3 and the piston g will then gradually escape through the pipe m, thereby allowing the spring f' to restore the auxiliary induction and exhaust valves to their normal position. By closing the circuit through the other motor the same operation will take place in the other auxiliary-valve apparatus, thereby admitting water to the other end of the cylinder F^2 to act upon the opposite side of the piston F' and move the main valve in the opposite direction, and this being continued the main valve will be reversed and the car caused to move in the opposite direction; or if it is desired to simply stop the car the circuit will be broken as soon as the main valve arrives in its mid-position, and the car will then remain at rest. As the piston F' is moved in either direction by the admission of water to one end of the cylinder F^2, the water in the other end of the cylinder will find an unobstructed escape through the pipe G or G', as the case may be, and past the auxiliary exhaust-valve e to the waste-pipe l. The waste-pipes m are, as will be observed, always open for the escape of water from the cylinder a'; but these pipes being of small size as compared with the pipes h, the water will not escape with sufficient rapidity to prevent the pistons g from operating properly.

The rods h^4 of the primary valves h^3 are preferably provided with sliding joints, as shown in Fig. 3, so as to permit those valves to accommodate themselves more readily to their seats.

Although the valves h^3 are herein illustrated as provided with means by which they are operated electrically, it is to be understood, as before stated, that these valves may be operated through other suitable connections with the car, if preferred.

In addition to the appliances for controlling the ordinary working movements of the elevator through the auxiliary-valve apparatuses which have been described, it is desirable that means should be provided by which, in case of an accident or in case the auxiliary-valve apparatuses should for any reason become ineffective, the conductor can operate the main valve or other mechanism which controls the movement of the car directly. For this purpose the rod F is provided with the usual rack, which is engaged by a pinion upon a shaft 21, having a pulley 20, around which passes a hand-rope 22, which extends around pulleys located at the top and bottom of the shaft and passes through the car in the usual manner.

It has already been stated that the auxiliary induction and exhaust valves d e are normally maintained in such position as to

open the pipes G G′ to allow the water to flow out of the cylinder from both sides of the piston F′, and thus permit the piston to be moved in either direction. From this it results that in case the auxiliary-valve mechanisms fail to act the main valve will not be locked by the water in the cylinder F^2, but will be free to be operated by the hand-rope 22 or other mechanical connection. This hand-rope will not be used in the ordinary working of the elevator; but in case of any emergency, as before stated, the conductor can, by means of this hand-rope, operate the main valve, and thus have mechanical control of the movements of the elevator, as in the old way.

The hand-rope 22 may be provided with the usual buttons located near the top and bottom of the shaft, and which will engage with the car and operate the main valve to stop the car before it reaches the limit of its movement in either direction. The ordinary hand-rope is herein illustrated as the simplest and, all things considered, the most desirable mechanical appliance for controlling the valve, in connection with the electrical appliances herein described; but it is to be understood that any of the other forms of mechanical connections by which the conductor in the car is enabled to control the main valve may be applied and used in place of the simple hand-rope shown, and are to be regarded in this connection as equivalents of said rope and included within the term "rope."

The form of motor C, for operating the elevator, which is herein shown, has been selected merely for the purpose of illustrating one application of the invention. Any other suitable form of motor may of course be employed.

What I claim is—

1. The combination, with the mechanism for controlling the movements of an elevator, of the cylinder F^2 and piston F′, for operating said mechanism, an auxiliary valve for controlling said piston, which is normally maintained in position to allow the water to flow out of the cylinder, a piston for operating said auxiliary valve, and a primary valve for controlling said last piston, substantially as described.

2. The combination, with the mechanism for controlling the movements of an elevator, of the cylinder F^2 and piston F′, for operating said mechanism, an auxiliary valve for controlling said piston, which is normally maintained in position to allow the water to flow out of the cylinder, a piston for operating said auxiliary valve, a primary valve for controlling said last piston, and a permanently-open exhaust between said last piston and said primary valve, substantially as described.

3. The combination, with the mechanism for controlling the movements of an elevator, of the cylinder F^2 and piston F′, for actuating said mechanism, an auxiliary-valve apparatus controlling said piston and normally maintained in an open position to allow the water to flow out of the cylinder from either side of the piston, pistons for operating said auxiliary-valve apparatus, primary valves for controlling said last pistons, and a rope connected to operate said controlling mechanism from the elevator, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES E. ONGLEY.

Witnesses:
T. H. PALMER,
G. M. BORST.

(No Model.) 3 Sheets—Sheet 1.

C. E. ONGLEY.

ELECTRICALLY CONTROLLED ELEVATOR.

No. 410,182. Patented Sept. 3, 1889.

Witnesses

Geo. H. Bolts

G. M. Borst

Fig. 1.

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Charles E. Ongley

By Philipp Phelps & Hovey

Attys

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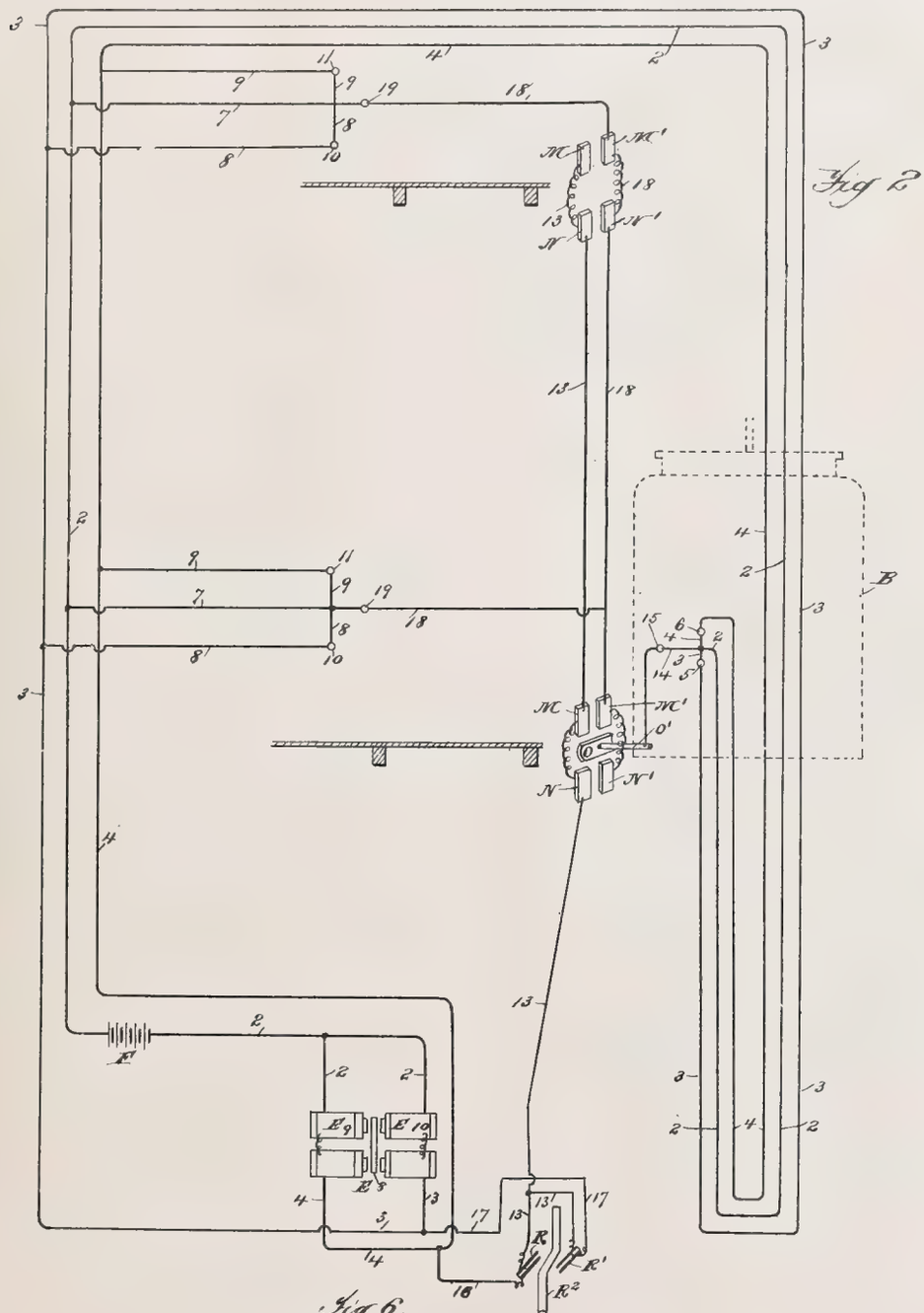
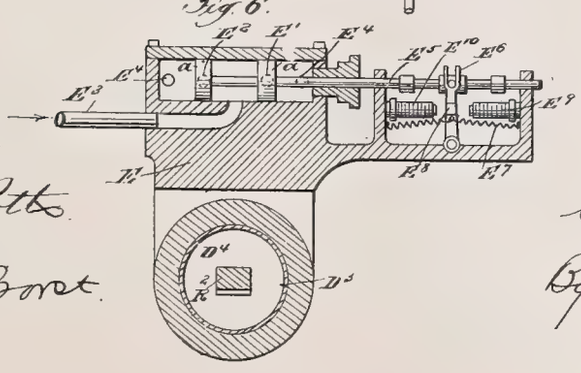


Fig 2.

Fig. 6.



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(No Model.) 3 Sheets—Sheet 3.

C. E. ONGLEY.

ELECTRICALLY CONTROLLED ELEVATOR.

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Fig 3

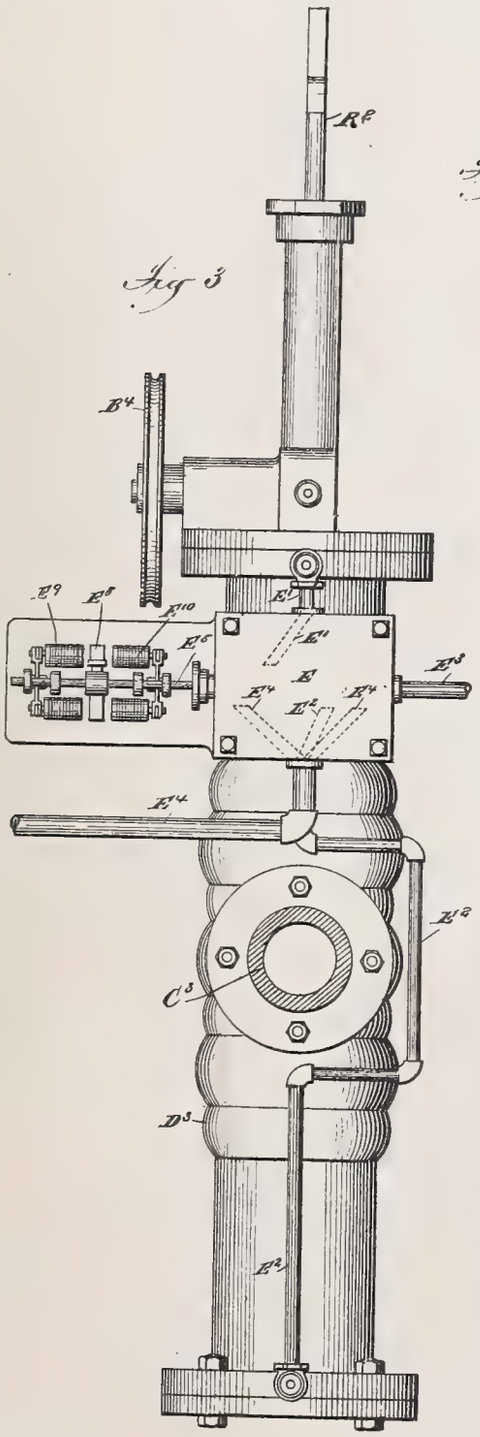


Fig 5.

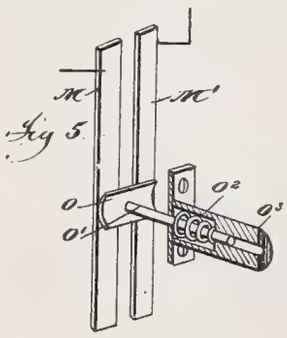
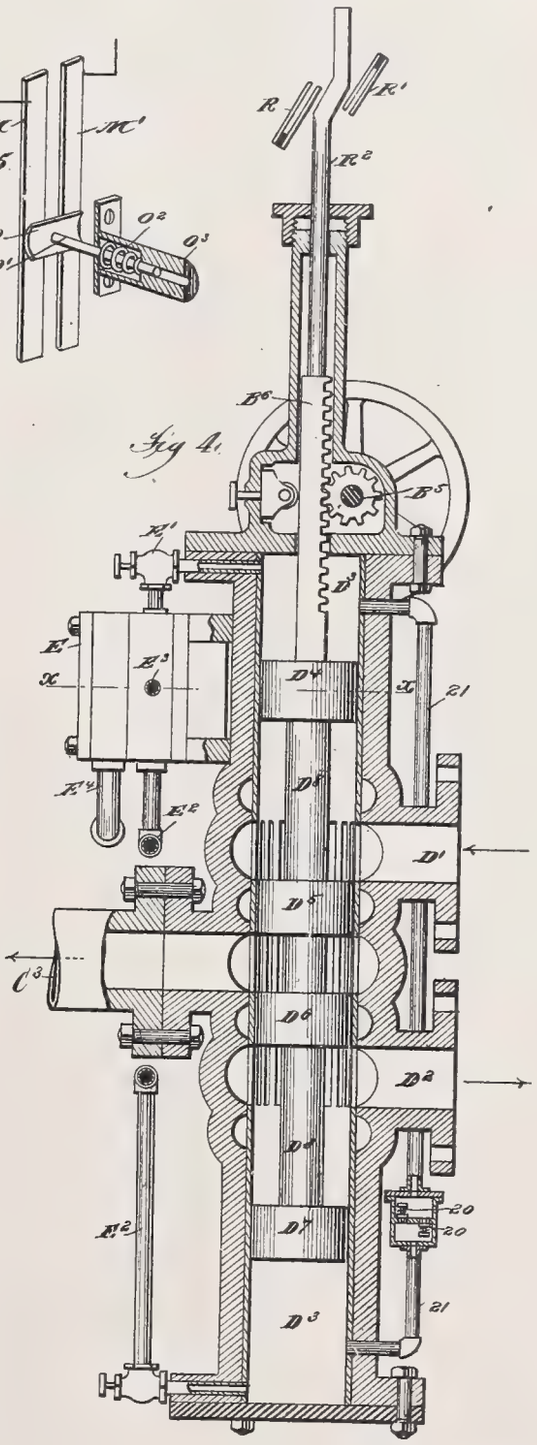


Fig 4.



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UNITED STATES PATENT OFFICE.

CHARLES E. ONGLEY, OF NEW YORK, N. Y., ASSIGNOR TO THE HYDRAULIC ELEVATOR COMPANY, OF ILLINOIS.

ELECTRICALLY-CONTROLLED ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 410,182, dated September 3, 1889.

Application filed April 18, 1888. Serial No. 271,103. (No model.)

To all whom it may concern.

Be it known that I, CHARLES E. ONGLEY, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in Elevators, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to an organized apparatus for controlling electrically the movements of an elevator-car, and particularly to a system of electrical connections by which the car is automatically arrested upon arriving in proper position at any landing.

The invention consists, principally, in a system of electrical connections for automatically accomplishing this result, which will now be fully described and particularly pointed out, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional elevation of a part of a building, showing the same provided with an elevator equipped with a system of electrical connections for controlling its movements according to the present invention. Fig. 2 is a diagram illustrating such system of electrical connections. Fig. 3 is an enlarged side elevation of the mechanism for controlling the movements of the elevator-car. Fig. 4 is a vertical sectional elevation of the same. Fig. 5 is an enlarged perspective view of a detail which will be hereinafter referred to. Fig. 6 is a horizontal section taken on the line *x* of Fig. 4.

Referring to said drawings, it is to be understood that A represents the elevator-shaft; G, the several landings or stories of the building; B, the elevator-car; C, a hydraulic cylinder or other motor by which the car is raised, and C^2 the hoisting-cable, all of which parts are organized in the usual and well-known manner.

D, Fig. 1, represents the mechanism for controlling the movements of the elevator-car, which, in the case shown, is the main induction and exhaust valve of the cylinder C, which is of any suitable construction to allow the water to be admitted to the cylinder to raise the car when the valve is in one position, to allow the water to escape from the cylinder to permit the car to descend when the valve is reversed, and to close both the induction and exhaust to stop the car when the valve is in an intermediate or mid position. This mechanism also includes an auxiliary valve and piston for operating the main valve. Such cylinders and valves are in common use, and their construction and operation are well known, and it is not necessary, therefore, to describe the same herein in detail, except in so far as will aid in giving an understanding of the electrical connections for operating the valve. The particular form of valve which has been selected for illustration in the present case will therefore be described in detail; but it is to be understood that the invention is not limited to a valve of this particular construction, but is equally applicable to other forms of valves for accomplishing the same results, or to whatever mechanism is used to control the movements of the motor.

It is also to be understood that where a hydraulic cylinder is employed it may, if preferred, be arranged vertically instead of horizontally, and may be provided with the well-known circulating-pipe, or may be arranged in any of the ways common in elevators.

Referring now particularly to Figs. 3 and 4, the construction and operation of the valve apparatus will be described. This apparatus consists of a cylinder D^3, having an induction-pipe D′, through which the water under suitable pressure is admitted to the cylinder; a pipe C^3, through which the water passes from the cylinder D^3 to the cylinder C, and a pipe D^2, through which the water is discharged after performing its work. The valve proper consists of two pistons D^5 and D^6, which work in the cylinder D^3, and are so arranged that when in their central or mid position they cut off communication between the pipe C^3 and both the pipes D′ D^2, but that by being moved from their mid-position they establish communication between the pipes D′ C^3, so as to allow the water to enter the cylinder C, or between the pipes C^3 and D^2, so as to allow the water in the cylinder C to escape, thus arresting the movement of the elevator-car or causing the car to ascend or descend in the well-known manner. The rod D^8, to which the pistons D^5 D^6 are secured, is extended beyond the

pistons and carries two auxiliary pistons D^4 D^7, which work in the ends of the cylinder D^3. Communicating with the ends of the cylinder D^3 above and below the pistons D^4 D^7 are induction and exhaust pipes E′ E^2, through which water is admitted to and exhausted from the cylinder D^3 to operate the pistons D^4 D^7 and their connected main valve in the manner just described. These induction and exhaust pipes are controlled by an auxiliary-valve apparatus E, which is operated by electromotors under control of the conductor in the car or of a person at any landing. The induction and exhaust pipes E′ E^2 may be extended so as to permit the auxiliary-valve apparatus E to be located in any convenient position, either near to or remote from the main-valve apparatus. As herein shown it is, however, located immediately at the side of the cylinder D^3. This auxiliary-valve apparatus consists, primarily, of a valve composed of two pistons *a*, (see Fig. 6,) located in a valve-chamber and so arranged that when in their mid-position they close the openings of the induction and exhaust pipes E′ E^2. The chamber in which the auxiliary valve is located is provided with an induction-pipe E^3, which opens between the two pistons *a* of the valve, and with exhaust-passages E^4, which lead from the opposite ends of the valve-chamber outside the pistons *a* to an exhaust-pipe E^4. The rod E^5, upon which the pistons *a* are secured, passes through a stuffing-box in the end of the valve-chamber and is connected to a pivoted lever E^6, to which is secured an armature E^8, which is acted upon so as to rock the lever in opposite directions by two electromotors E^9 E^{10}, located upon the opposite sides of the armature. The lever E^6 is normally held in a mid-position, so as to hold the armature E^8 centrally between the two electromotors, and the auxiliary valve in position to close both the induction and exhaust pipes E′ E^2, by means of equalizing-springs E^7.

The auxiliary valve which has been described is given merely for the purpose of illustrating the operation of the invention. Any other suitable form of valve may, however, be employed, if preferred. For example, the induction and exhaust pipes E′ E^2 may be controlled by separate auxiliary-valve apparatuses, such as described in my prior application for Letters Patent filed November 22, 1887, Serial No. 255,857, or the electromotors may act directly upon the main valve.

The electromotors E^9 E^{10} are herein shown as ordinary electro-magnets, and will hereinafter be referred to in the specification and claims as magnets; but it is to be understood that the term as herein used includes any form of electromotor which is capable of being energized by the passage through it of an electric current.

The operation of the apparatus as thus far described is as follows: The pistons *a*, forming the auxiliary valve, are, as before stated, normally held by the equalizing-springs E^7 in position to close the induction and exhaust pipes E′ E^2, and thereby prevent any water from entering those pipes to act upon the pistons D^4 D^7 and operate the main valve. As soon, however, as one of the magnets (E^9, for example) is energized by the closing of the electric circuit in which the magnet is located, the armature E^8 will be attracted, thereby rocking the lever E^6 and moving the auxiliary valve so as to open communication between the induction-pipe E^3 and the pipe E′, and thereby allow the water to enter the pipe E′ and pass to the cylinder D^3 above the piston D^4. At the same time the pipe E^2 and the passage E^4 at that end of the auxiliary-valve chamber will be brought into communication, so as to allow the water confined in the cylinder D^3 below the piston D^7 to escape through the pipe E^2 and pass to the exhaust-pipe E^4. This will cause the main valve to move downward and allow the water to pass from the induction-pipe D′ into the pipe C^3, and thence to the cylinder C, and act upon the piston in that cylinder so as to raise the car. As soon as the circuit through the magnet E^9 is broken the magnet will be de-energized, so as to release the armature E^8, and as soon as this is done the equalizing-springs E^7 will rock the lever E^6 back to its mid-position, and thereby restore the pistons *a*, forming the auxiliary valve, to position to close both the induction and exhaust pipes E′ E^2, and shut off the further admission and exhaust of water to and from the cylinder D^3, and thus arrest the movement of the main valve and hold it in any position in which it is at that time. By closing the circuit through the other magnet the auxiliary valve will be moved in the opposite direction, thereby admitting water to the cylinder D^3 beneath the piston D^7, and allowing the escape of the water from above the piston D^4, so as to move the main valve upward, and this being continued the main valve will be reversed, so as to cause the car to descend; or if it is desired to simply stop the car the circuit will be broken as soon as the main valve arrives in its mid-position, and the car will then remain at rest.

The system of electrical connections by which the magnets E^9 E^{10} are energized to operate the auxiliary valve, as just described, will now be explained.

One pole of each of the magnets is connected to a wire 2, which includes a suitable battery F and leads to the elevator-car, where it is connected to two wires 3 4, which return to the other poles of the respective magnets. The courses of these circuits, and also of the circuits to be hereinafter referred to, can readily be traced by reference to Fig. 2 of the drawings. The wires 2 3 4 are connected to the traveling car by being formed into a cable G^3, (see Fig. 1,) which hangs in the shaft with sufficient slack to allow for the travel of the car. The circuits 2 3 and 2 4 thus formed,

each of which includes one of the magnets, are provided with push-buttons or other circuit-closers 5 6, located upon the car. The term "push-button" is herein used for convenience, and it is to be understood as including any means for making and breaking the circuits.

From the description of the auxiliary-valve apparatus which has already been given it will readily be seen that by operating the button 5 to close the circuit 2 3, and thus energize the magnet E^{10}, the car will be caused to descend, and that by releasing said button, so as to break the circuit 2 3 and de-energize the magnet, and then operating the button 6 to close the circuit 2 4 and energize the magnet E^9, the car will be stopped or caused to ascend, according to the length of time the circuit 2 4 is kept closed, and vice versa.

There are many cases where it is desirable, in addition to the means for controlling the movements of the elevator from within the car, that there should also be provided means by which a person at any landing can cause the car to ascend or descend to that landing. To enable this to be accomplished, the circuits 2 3 and 2 4 are respectively provided with branch circuits 7 8 and 7 9, which include push-buttons 10 11, located at each landing, as also indicated in Fig. 2. By this means a person at any landing can by operating the button 10 or 11 cause the car to descend or ascend, as the case may be, to that landing, and can then arrest the car by operating the other button, in the same manner as already described in connection with the buttons upon the car. The push-buttons and branch circuits for only two landings are indicated in the diagram; but it will readily be understood that the circuits and buttons at any number of landings can be arranged in the same manner.

From what has been said it will be seen that the circuits 2 3 and 2 4 and their branches 7 8 and 7 9 are sufficient to enable a person either in the car or at any landing to cause the car to ascend or descend and to come to rest at any desired point. In order, however, to stop the car in exactly the proper position at any landing, it is necessary to close the circuit which is to reverse the main valve at such a time before the car arrives at the landing that the time required for the main valve to arrive at its mid-position will be just sufficient to allow the car to arrive at that landing; and it will also be seen that in order to retain the car at the place where it is stopped it is necessary to break the circuit as soon as the car stops. If the person operating the elevator is skillful and attentive, this will occasion no special difficulty, because such a person will be able to close and break the circuit at the proper time; but with an unskillful or inattentive operator this might occasion some trouble and annoyance, and it is therefore desirable to provide means by which, when it is desired to stop the car and retain it at any landing, the circuit will be automatically closed and broken at the proper time to effect this result. For this purpose there is provided a circuit-closer which is operated by the car, and which consists of a contact-plate O, (see Fig. 5,) having a spindle O′, which enters a socket O^3, set into some convenient portion of the car—preferably near its bottom—and is provided with a spring O^2, which acts to press the plate O outward, so that as the car moves up and down the elevator-shaft the plate passes in contact with a series of plates M N, arranged on the side of the shaft and located, respectively, just above and below the position of the plate O when the car is in position at each landing. These plates M N are connected with each other and with the wires 3 4 by means of wires 13 17 and 13 16, and the plate O is connected to the wire 2 by means of a wire 14, which includes a push-button 15, located upon the car. The wires 16 17 include circuit-closers consisting of spring contact-plates R R′, which are located adjacent to a rod R^2, which forms an extension of the rod D^8 of the main valve, or which is connected to the main valve or some other moving part of the engine so as to be moved in unison with the valve. This rod R^2 is provided with two oppositely-arranged shoulders, which are so located that when the main valve is in its mid-position neither of the pairs of contact-plates R R′ will be acted upon and the circuits through the wires 16 17 will be broken, but that when the valve is moved up or down from its mid-position one or the other of the pairs of contact-plates—depending upon which way the valve is moved—will be engaged by the corresponding shoulder upon the rod R^2, so as to bring the plates together and close the circuit through the wire 16 or 17, as the case may be.

The contact-plates M N are of such length vertically that the length of time which the plate O will remain in contact with either of the plates as the car is descending or ascending will be just sufficient to allow the main valve to move to its mid-position and arrest the car; and the plates are so positioned with relation to the different landings that whenever the plate O passes out of contact with the plate M as the car descends, or out of contact with the plate N as the car ascends, the car will be in proper position in front of the landing. Assuming now that the main valve has been moved downward from its mid-position, so as to cause the car to ascend, and thus bring the contact-plates R′ together, so as to close the circuit through the wire 17 at that point, it is only necessary then, in order to stop the car and retain it at any landing, to press the button 15 as the car approaches the landing. As soon as the contact-plate O arrives in contact with the plate N the circuit will be completed through the magnet E^{10}, thereby energizing that magnet, so as to operate the auxiliary valve and

cause the main valve to move upward until it arrives at its mid-position, so as to stop the car. As soon as the valve arrives in this position the shoulder on the rod R^2 will pass out of contact with the plates R', and thus break the circuit through the wire 17 and arrest the main valve and retain the car in proper position at the landing. If the main valve has been moved upward from its mid-position, so as to cause the car to descend, the operation of stopping and retaining the car will be the same, except that in this case the plates R will be brought together, so as to close the circuit through the wire 16, and the plate O will come into contact with the plate M, so as to close the circuit through the magnet E^9 instead of through the magnet E^{10}. To enable the same operation to be performed from any landing, the elevator-shaft is provided with a second series of contact-plates M' N', corresponding to the plates M N, and arranged at the sides of the latter plates in position to be also engaged by the plate O, carried by the car, so that when the plate O is in contact with the plates M M' and N N' it serves to connect them electrically. These plates are connected with each other and with the wire 7 by wires 18, which include push-buttons 19, located at each landing. By operating the buttons 19 the car will be automatically arrested in proper position at any landing, the same as in operating the button 15 upon the car, as just described.

In addition to the electrical appliances which have been described for controlling the ordinary working movements of the elevator, it is desirable that means should be provided by which in case of an accident, or in case the electrical appliances should for any reason become ineffective, the conductor can have control of the main valve by means of mechanical connections. For this purpose the valve-rod D^8 is provided with the usual rack, which is engaged by a pinion B^5, the shaft of which is provided with a pulley B^4, around which passes an ordinary hand-rope B', which extends around pulleys B^3, located at the top and bottom of the shaft, and passes through the car in the usual manner. To permit the main valve to be operated by this hand-rope in case of an emergency, as just stated, the cylinder D^8 is provided with a circulating-pipe 21, having oppositely-arranged spring-controlled check-valves 20, as shown in Fig. 4, to permit the water to circulate between the ends of the cylinder D^8 above and below the pistons as the valve is thus moved. The springs controlling these check-valves are placed under such tension as to close the valves against the pressure necessary for the ordinary working movements of the valve. These springs will, however, yield and permit the circulation of water when power is applied to the hand-rope to operate the valve in that manner.

The ordinary hand-rope is herein illustrated as the simplest and, all things considered, the most desirable mechanical appliance for controlling the valve in connection with the electrical appliances herein described; but it is to be understood that any of the other forms of mechanical connections by which the conductor in the car is enabled to control the main valve may be applied and used in place of the simple hand rope shown.

I do not herein claim the subject-matter herein shown and claimed in my companion applications filed November 22, 1887, Serial No. 255,857, and January 22, 1889, Serial No. 297,127.

What I claim is—

1. The combination, with an elevator-car and the mechanism for controlling its movements, of an electro-magnet for operating said controlling mechanism, a circuit-closer 15 or 19 in circuit with the magnet, and a circuit-closer operated by the car to close the circuit through the magnet shortly before the car arrives at a landing, substantially as described.

2. The combination, with an elevator-car and the mechanism for controlling its movements, of an electro-magnet for operating said controlling mechanism, a circuit-closer 15 or 19 in circuit with the magnet, and a circuit-closer operated by the car to close the circuit through the magnet shortly before the car arrives at a landing, and to break the circuit as the car arrives at the landing, substantially as described.

3. The combination, with an elevator-car and the mechanism for controlling its movements, of an electro-magnet for operating said controlling mechanism, a circuit-closer 15 or 19 in circuit with said magnet, a circuit closer R or R', operated by a moving part of the elevator mechanism to close the circuit through the magnet when the car is in motion and to break the circuit when the car is at rest, and a circuit-closer operated by the car to close the circuit through the magnet shortly before the car arrives at a landing, substantially as described.

4. The combination, with an elevator-car and the mechanism for controlling its movements, of electro-magnets for operating said controlling mechanism to cause the car to move in opposite directions, a circuit-closer 15 or 19 in circuit with both the said magnets, and a circuit-closer operated by the car to close the circuit through one of said magnets shortly before the car arrives at a landing going down, and through the other of said magnets shortly before the car arrives at the landing going up, substantially as described.

5. The combination, with an elevator-car and the mechanism for controlling its movements, of electro-magnets for operating said controlling mechanism to cause the car to move in opposite directions, a circuit-closer 15 or 19 in circuit with both the said magnets, a circuit-closer operated by the car to close the circuit through one of said magnets shortly before the car arrives at a landing

going down, and through the other of said magnets shortly before the car arrives at the landing going up, and circuit-closers R R′, operated by a moving part of the elevator mechanism to close the circuit through one of said magnets when the car is in motion and to break the circuits through both of said magnets when the car is at rest, substantially as described.

6. The combination, with an elevator-car and the mechanism for controlling its movements, of an auxiliary cylinder and piston for operating said controlling mechanism, an electro-magnet for actuating the auxiliary valve, an electric circuit including said magnet and a circuit-closer on the car, and a circulating-passage having a check-valve for permitting the water to circulate from one side to the other of the auxiliary piston, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES E. ONGLEY.

Witnesses:
J. A. HOVEY,
J. J. KENNEDY.

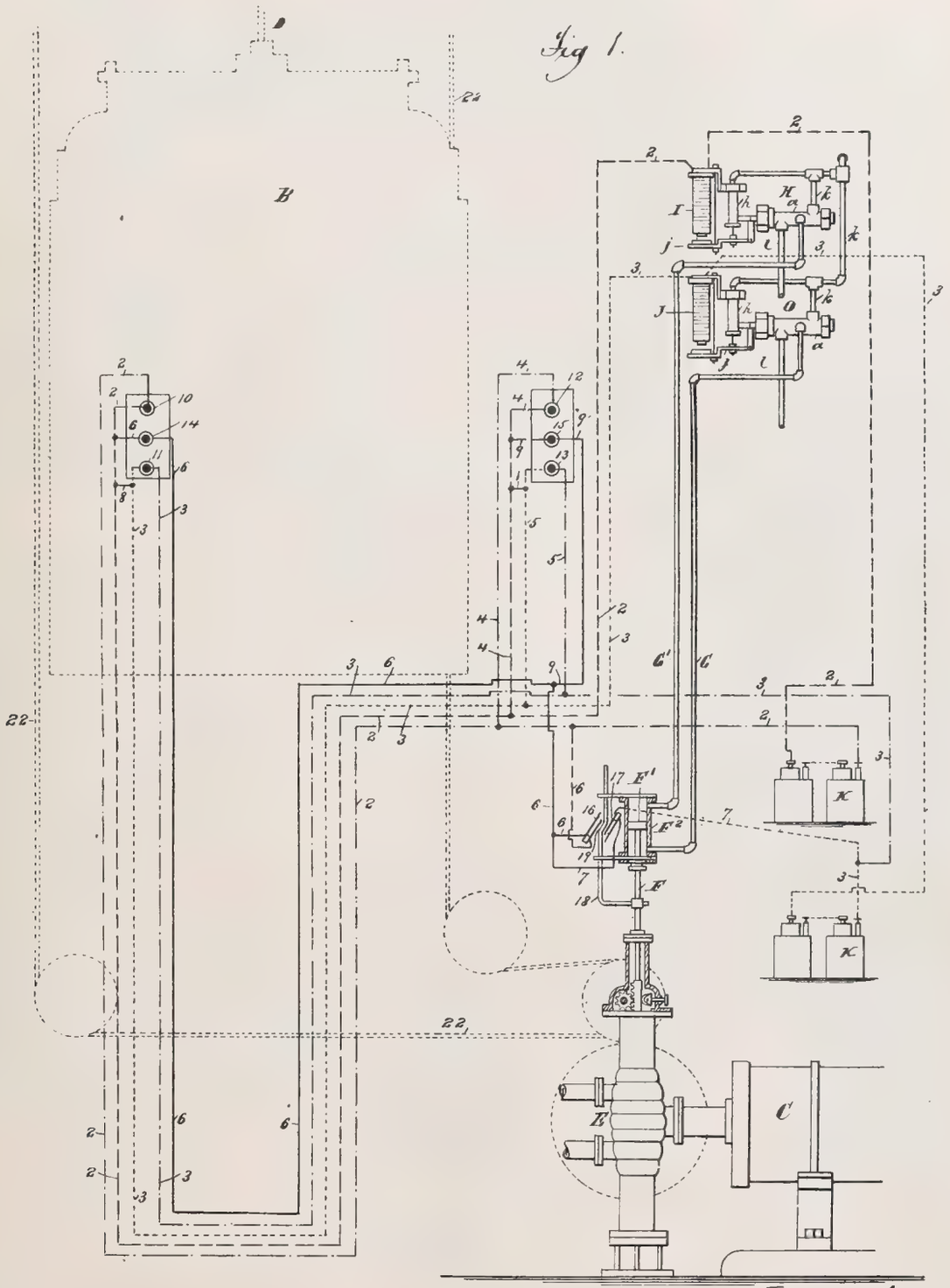
(No Model.) 2 Sheets—Sheet 1.

C. E. ONGLEY.

ELECTRICALLY CONTROLLED ELEVATOR.

No. 410,184. Patented Sept. 3, 1889.

Fig 1.



Attest:
Geo. H. Botts.
J. M. Borst

Inventor:
Charles E. Ongley
By Philip Philips & Hovey
Attys

THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON D. C.

(No Model.) 2 Sheets—Sheet 2.

C. E. ONGLEY.

ELECTRICALLY CONTROLLED ELEVATOR.

No. 410,184. Patented Sept. 3, 1889.

Fig. 2.

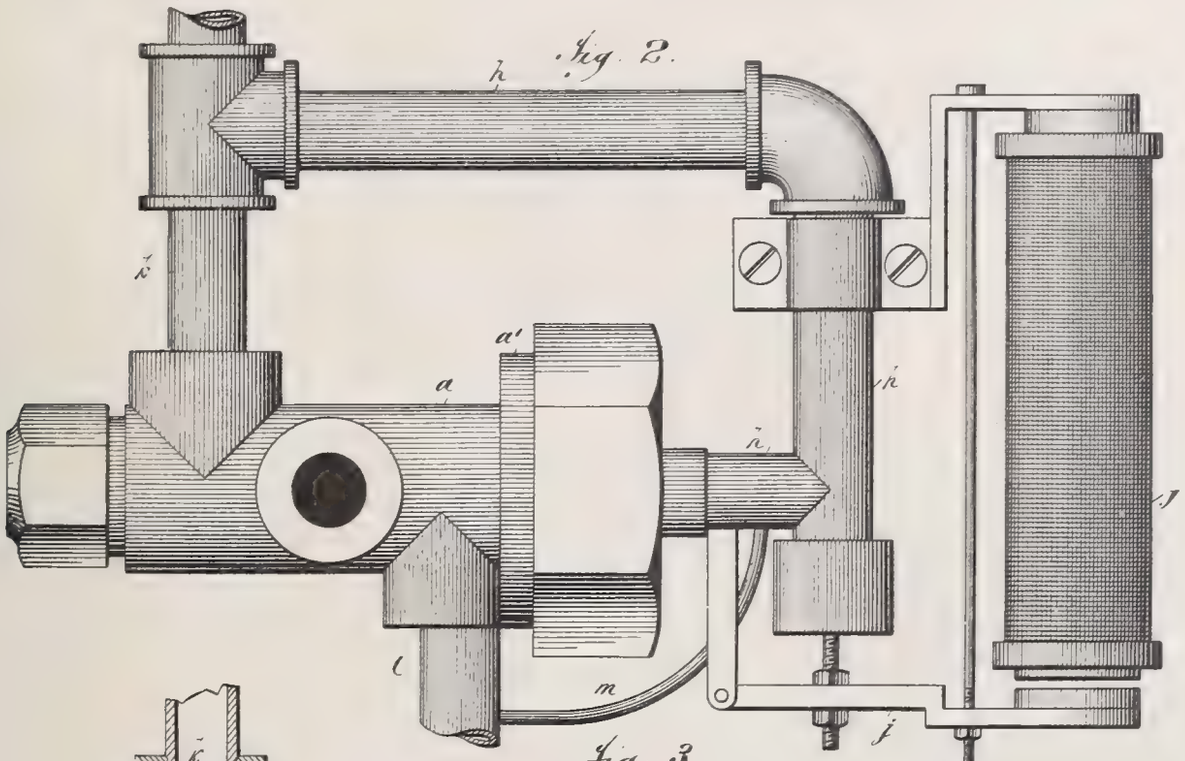
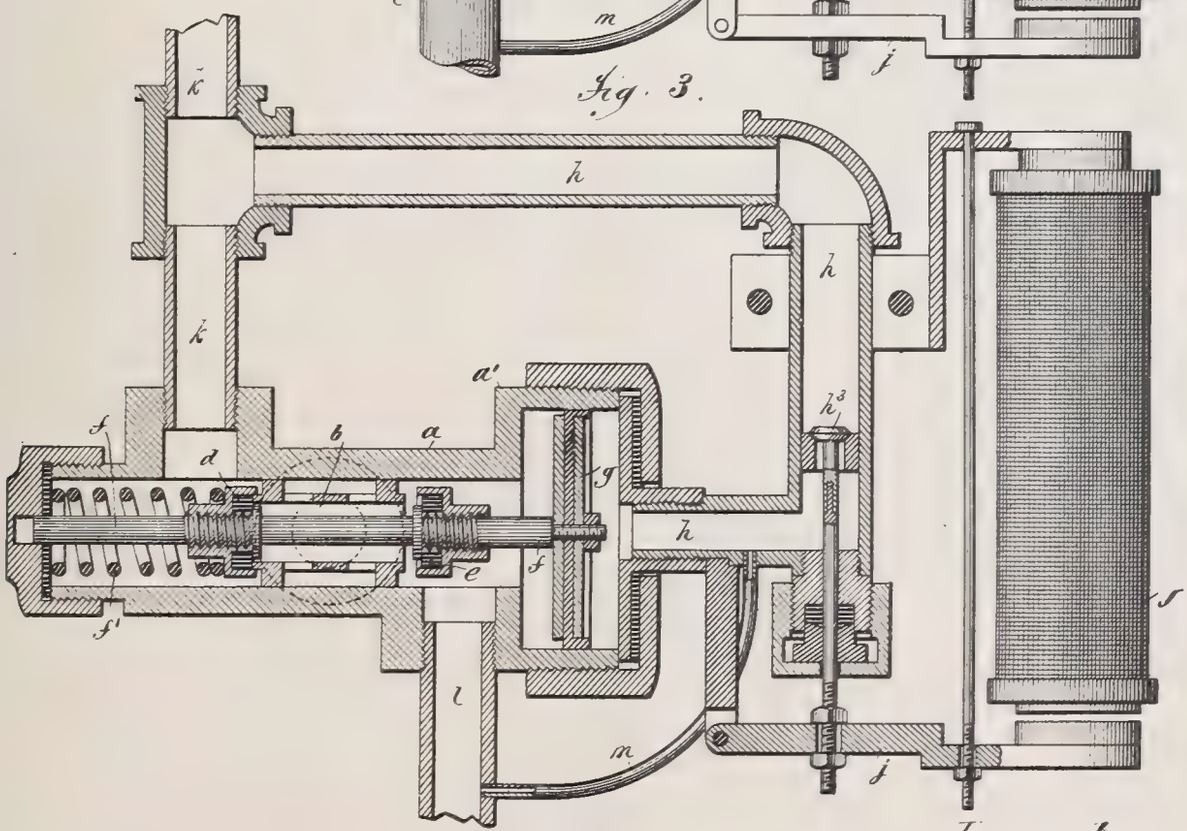


Fig. 3.



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UNITED STATES PATENT OFFICE.

CHARLES E. ONGLEY, OF YONKERS, NEW YORK, ASSIGNOR TO THE HYDRAULIC ELEVATOR COMPANY, OF ILLINOIS.

ELECTRICALLY-CONTROLLED ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 410,184, dated September 3, 1889.

Original application filed November 22, 1887, Serial No. 255,857. Divided and this application filed January 22, 1889. Serial No. 297,127. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. ONGLEY, a citizen of the United States, residing at Yonkers, county of Westchester, and State of New York, have invented certain new and useful Improvements in Electrically-Controlled Elevators, fully described and represented in the following specification, and the accompanying drawings, forming a part of the same.

This invention relates to an organized apparatus for operating electrically the main valve or other mechanism which controls the movements of an elevator from the landings of the elevator-shaft and also from the elevator-car.

The invention consists, primarily, in an organized system of electrical connections by which the movements of the elevator-car can be controlled from the landings of the elevator-shaft, and also in an organized system of electrical connections by which the movements of the car can also be controlled from within the car.

In the accompanying drawings, Figure 1 is a diagram illustrating the several electric circuits and the means by which the movements of the elevator are controlled through said circuits either from the car or from the landings of the elevator-shaft. Fig. 2 is an enlarged elevation of the auxiliary-valve apparatus and its electro-magnet, by which the main valve or other controlling mechanism of the elevator is moved in one direction. Fig. 3 is a sectional view of the same.

Referring to said drawings, it is to be understood that B represents the elevator-car, C a hydraulic cylinder or other motor by which the car is raised, and D the hoisting-cable, which is connected to the motor in the usual manner, all of these parts being organized in the usual and well-known way.

E represents the mechanism for controlling the movements of the elevator, which in the case shown is the main valve of the cylinder C, and is of any suitable form to allow water to be admitted to the cylinder to cause the car to ascend, to allow the water to escape from the cylinder to cause the car to descend, and to close both the admission and discharge to stop the car when the valve is in an intermediate or mid position. Such cylinders and valves being in common use, their construction is well known, and it is not, therefore, necessary to further illustrate or describe the same. It is to be understood, however, that the cylinder C may, if preferred, be arranged vertically instead of horizontally, and may be provided with the well-known circulating-pipe, or it may be a motor of any of the forms common in elevators. The mechanism for controlling the movements of the motor, and through it the movements of the car, is therefore herein termed the "main valve," and this term is to be understood as including any suitable form of mechanism for controlling the movements of the motor, which mechanism will be determined in each case by the character of the motor employed.

The main valve is operated by means of a piston F′, which works in a cylinder F^2 and is connected by a rod F to the main valve. The cylinder F^2 is provided with induction and exhaust pipes G G′, forming ports through which the water is allowed to flow into and out of the cylinder upon the opposite sides of the piston, moving it and the connected main valve in the required direction.

The pipes G G′ are controlled by means of what I term "auxiliary-valve mechanisms" H O, which are operated by electro-magnets under the control of the conductor or of a person at any landing. Ordinary electro-magnets are herein shown for actuating the valves, but the term "magnet" as herein used is to be understood as including any form of electro-motor which can be energized by an electric current.

The valve mechanisms H O are alike in construction and operation, and have for convenience a common water-supply, one valve controlling the pipe G and the other the pipe G′. These valves are controlled by electro-magnets I J, which are energized through electric circuits which include batteries K and appropriate circuit-closers located at the different landings and on the car. The two mechanisms H O being exact duplicates, a description of one will apply to both.

Referring particularly to Figs. 2 and 3, it is to be understood that *a* is a valve-cylinder containing two valve-seats formed upon the ends of a bushing *b*, having perforations and two heads which are securely fastened in the cylinder. The auxiliary valve consists of two heads *d e*, which are connected by a rod *f*, to which a spiral spring *f'* is applied to hold the head *d* against its seat and the head *e* away from its seat. The valve-cylinder is enlarged at one end to form what I term a "primary cylinder" *a'*, in which is fitted a piston *g*, which is attached to the rod *f*. Communicating with the primary cylinder is a pipe *h*, which is controlled by a primary valve h^3, the rod of which is adjustably connected by nuts to a lever *j*, carrying at its free end the armature of the electro-magnet J or I, as the case may be. The water-supply pipe *k* communicates with the cylinder *a* and also with the pipe *h*, and the pipes G G' communicate with the cylinders *a* of the respective valve apparatuses H O between the valve-seats formed by the bushing *b*. Each of the cylinders *a* is provided with a waste-pipe *l*, which communicates with the space between the head *e* and the piston *g*, and each of the pipes *h* is provided with a small open waste-pipe *m* or other vent which affords communication between the opposite sides of the piston *g*.

The operation of this part of the mechanism is as follows: The pressure of the water in the pipe *k*, aided, if necessary, by the springs *f'*, operates to normally maintain the auxiliary valves in such position that no water is permitted to pass from the pipe *k* to the pipes G G' to act upon the piston F' and operate the main valve. When the valves are in this position, however, free communication is afforded between the pipes G G' and the pipes *l*, so that any water contained in the cylinder F^2 can readily flow out of the cylinder, thereby preventing the piston F' from being water-locked and permitting it and the connected main valve to be moved freely in either direction. As soon, however, as either one of the magnets I J is energized its armature will be attracted, thus opening the valve h^3 and allowing the water from the pipe *h* to enter the cylinder *a'* and act upon the piston *g*, and as the area of the piston *g* exceeds that of the head *d* of the valve the valve will be moved so as to shut off communication between the pipe *l* and the pipe G or G', as the case may be, and at the same time open communication between the pipe *k* and said pipe G or G', and allow the water to pass from the pipe *k* into the cylinder F^2 to move its piston and the connected main valve. As soon as the magnet is de-energized the valve h^3 will be restored to its closed position and the water contained in the cylinder *a'* in front of the piston *g* will gradually escape through the pipe *m*, thereby allowing the water-pressure and the spring *f'* to restore the auxiliary valve to its normal position and shut off the further flow of water to the cylinder f^2, and thereby arrest the movement of its piston and the main valve. By closing the circuit through the other magnet the same operation will take place, thereby moving the main valve in the opposite direction, and, this being continued, the valve will be reversed and the car caused to move in the opposite direction; or, if it is desired to simply stop the car the magnet will be de-energized as soon as the main valve arrives at its mid-position. As the piston F' is moved in either direction the water in the cylinder in front of the piston will find an unobstructed escape to the pipe *l*. The pipes or vents *m* are always open; but these pipes being of small size as compared with the pipes *h* the water will not escape with sufficient rapidity to prevent the pistons *g* from operating properly.

The system of electrical connections by which the magnets I J are energized to effect the operation just described will now be explained. In this explanation it will be assumed that the apparatus H, which includes the magnet I, controls the ascent of the car, and that the apparatus O, including the magnet J, controls the descent of the car. In the organization herein shown the two magnets are energized by separate batteries K. This is preferable, but is not in all cases necessary, as a single battery may be employed for both magnets. The magnet I is located in an electric circuit formed by wires or other electrical conductors 2, which circuit includes one of the batteries and a push-button 10, located upon the car. The course of this circuit and also of the other circuits to be referred to can readily be traced by reference to Fig. 1. The term "push-button" is herein used for convenience, and it is to be understood as including any means of making and breaking circuits. The magnet J is located in a similarly-arranged circuit 3, which includes the other one of the batteries and a push-button 11 upon the car.

From the description of the operation of the auxiliary-valve apparatus which has been given it will readily be seen that by operating the push-button 10 to close the circuit 2 and energize the magnet I the car will be caused to ascend, and that by releasing said button, so as to break the circuit 2 and de-energize the magnet I, and then operating the button 11 to close the circuit 3 and energize the magnet J, the car will be stopped or caused to descend, according to the length of time the circuit is kept closed, and vice versa.

There are many cases where it is desirable, in addition to controlling the movements of the car from within the car, that there should also be provided means by which a person at any landing can cause the car to ascend or descend to that landing. To enable this to be accomplished, the circuits 2 3 are respectively provided with branch circuits or loops 4 5, which include push-buttons 12 13, located at each landing, as indicated in Fig. 1. By this means a person at any landing can by

operating the button 12 or 13 cause the car to ascend or descend, as the case may be, to that landing, and can then arrest the car by operating the other button in the same manner as already described in connection with the buttons upon the car.

The push-buttons for only one landing are indicated in the drawings; but it will readily be understood that the buttons at any number of landings can be arranged and connected to the circuits 2 3 in the same manner.

From what has been said it will be seen that the two circuits 2 3 and their respective branches 4 5 are sufficient to enable a person to control the movements of the car. In order, however, to bring the car to rest and retain it at any point, it is necessary, as has been explained, to break the circuit as soon as the car stops, as if the circuit continues closed after the car has stopped the main valve will be moved onward past its mid-position, and thus cause the car to start in the opposite direction from which it was moving before it stopped. With an unskillful or inattentive operator this might occasion some trouble and annoyance, and it is therefore desirable to provide means by which, when it is desired to stop and retain the car in any position, the circuit will be automatically broken at the proper time to effect this result. For this purpose the circuit 2, which includes the magnet I, is provided with a branch 6, which includes a push-button 14, located upon the car, and also a pair of spring contact plates or brushes 16, located in the case illustrated near the cylinder F^2. This branch is in turn provided with a branch 7, which leaves the branch 6 between the button 14 and the brushes 16 and unites with the circuit 3 at a point between the battery and the button 11. This branch 7 is also provided with a pair of brushes 17, similar to the brushes 16. The circuits 2 3 are also connected by a branch 8, which connects the two circuits at a point between the buttons 11 14. The brushes 16 17 are located adjacent to a rod 18, which is connected to the rod F and reciprocates through guides secured to the side of the cylinder F^2, or this rod may be similarly reciprocated by some other moving part of the mechanism. This rod is provided with oppositely-inclined shoulders 19, forming a circuit-closer, which is so arranged that when the main valve is in its mid-position the circuits through the branches 6 7 will be both broken. When, however, the valve is moved upward from its mid-position, so as to cause the car to decend, the brushes 16 will be acted on by the circuit-closer 19, so as to be brought together, thereby closing the circuit through the branch 6, which circuit will then remain closed until the valve is moved back to its mid-position. As the valve is moved downward from its mid-position, so as to cause the car to ascend, the brushes 17 will be operated upon in the same manner, so as to close the circuit through the branch 7, which circuit will remain closed until the main valve is again moved back to its mid-position. It will thus be seen that as soon as the valve, moving in either direction, arrives at its mid-position the circuits through both the branches 6 7 will be automatically broken. From this it results that whenever it is desired to stop the car it is only necessary to press the button 14. The circuit will then be completed through the magnet I or J, depending upon the direction in which the car is moving, and the magnet will be energized and operate the auxiliary-valve mechanism to cause the main valve to be moved back to its mid-position, and as soon as the main valve arrives at its mid-position the circuit will be automatically broken, thereby arresting the main valve, whether the attendant breaks the circuit by releasing the button or not. To enable the same operation to be performed from any landing, it is only necessary to provide the branches 4 with branches 9, which connect with the branch 6, and in which are located push-buttons 15 at each landing, and to connect the branches 4 5, as indicated at 1.

In addition to the electrical appliances which have been described for actuating the main valve in the ordinary working of the elevator, there is shown in the drawings connections by which the main valve can also be operated by an ordinary hand-rope 22.

The particular form of auxiliary-valve mechanism which has been shown and described has been selected merely for the purpose of illustration, and may be widely departed from without departing from the present invention, which relates to the system of electrical connections in connection with which any suitable form of auxiliary-valve mechanism may be employed, and in some cases the auxiliary-valve mechanism may be entirely omitted, the electromotor being arranged to actuate the main valve without the interposition of an auxiliary valve.

The system of electrical connections which have been described by which the circuits are broken automatically, so as to prevent the movement of the car from being reversed after it has been stopped, also the combination, with electrical appliances for actuating the main valve, of a hand-rope or other mechanical connection for operating said valve, and also the particular auxiliary-valve apparatus herein shown and described, and the combination therewith of electrical appliances for actuating the main valve through said auxiliary-valve apparatus, are not herein claimed, as these features form the subject-matter of my prior applications for Letters Patent, filed November 22, 1887, Serial No. 255,857, and March 9, 1888, Serial No. 266,653, of which former application the present is a division.

What I claim is—

1. The combination, with an elevator-car, its motor, and main valve, of an electro-magnet for actuating said main valve, a circuit-

closer upon the car, which is in circuit with said magnet, and circuit-closers at the landings, also in circuit with said magnet, substantially as described.

2. The combination, with an elevator-car, its motor, and main valve for controlling its movements, of an electro-magnet for actuating said main valve, and circuit-closers located at the landings which are in circuit with said magnet, substantially as described.

3. The combination, with an elevator-car, its motor, and main valve for controlling its movements, of electro-magnets for actuating said main valve to cause the car to move in opposite directions, circuit-closers upon the car which are in circuit with said respective magnets, and corresponding circuit-closers at the landings, also in circuit with said respective magnets, substantially as described.

4. The combination, with an elevator-car, its motor, and main valve for controlling its movements, of electro-magnets for actuating said main valve to cause the car to move in opposite directions, and circuit-closers at the landings which are in circuit with said respective magnets, substantially as described.

5. The combination, with an elevator-car, its motor, and main valve for controlling its movements, of an auxiliary valve, an electro-magnet for actuating said auxiliary valve, and an electric circuit including circuit-closers at the landings, substantially as described.

6. The combination, with an elevator-car, its motor, and main valve for controlling its movements, of auxiliary valves for controlling the movements of the main valve in opposite directions, electro-magnets for actuating said auxiliary valves, and circuit-closers at the landings in circuit with said respective magnets, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES E. ONGLEY.

Witnesses:
J. J. KENNEDY,
E. M. BORST.

(No Model.) 2 Sheets—Sheet 1.

C. W. BALDWIN.

STARTING AND STOPPING DEVICE FOR ELEVATORS.

No. 416,983. Patented Dec. 10, 1889.

Fig. 4.

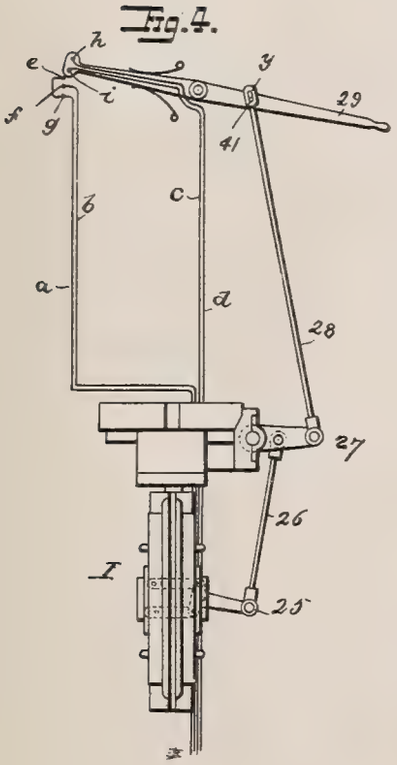
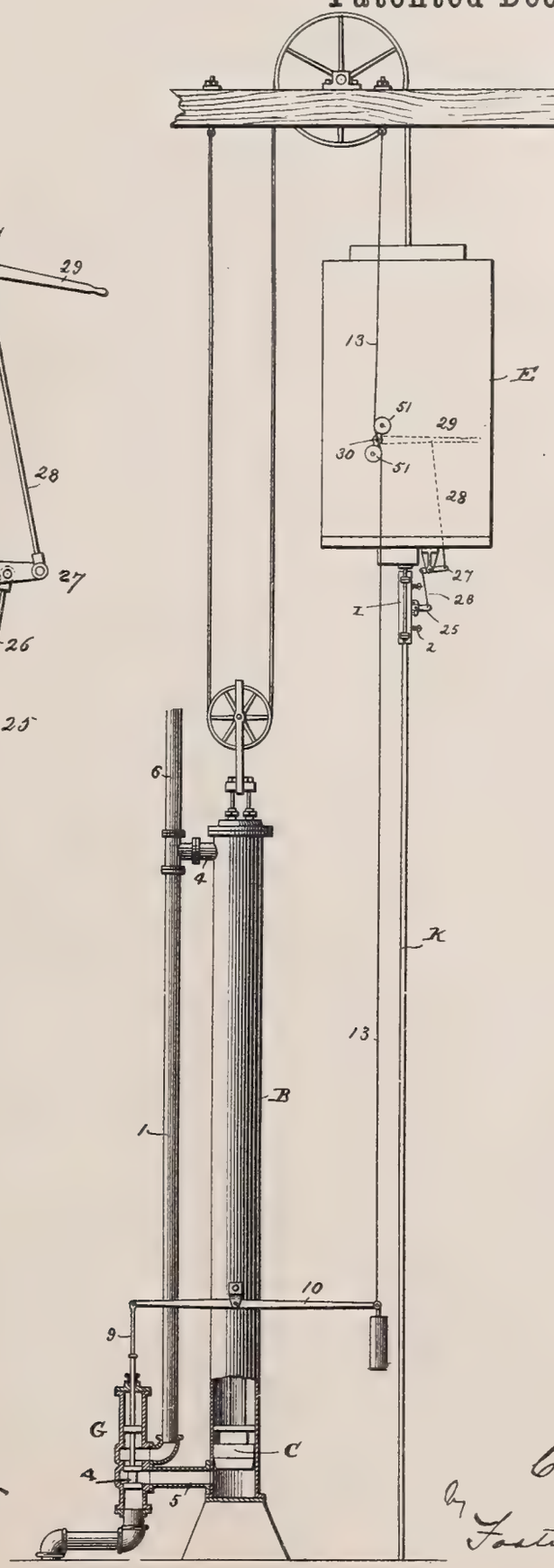


Fig. 1.



Witnesses
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S. D. Johnson

Inventor
C. W. Baldwin
by Foster & Freeman
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(No Model.) 2 Sheets—Sheet 2.

C. W. BALDWIN.

STARTING AND STOPPING DEVICE FOR ELEVATORS.

No. 416,983. Patented Dec. 10, 1889.

Fig. 2.

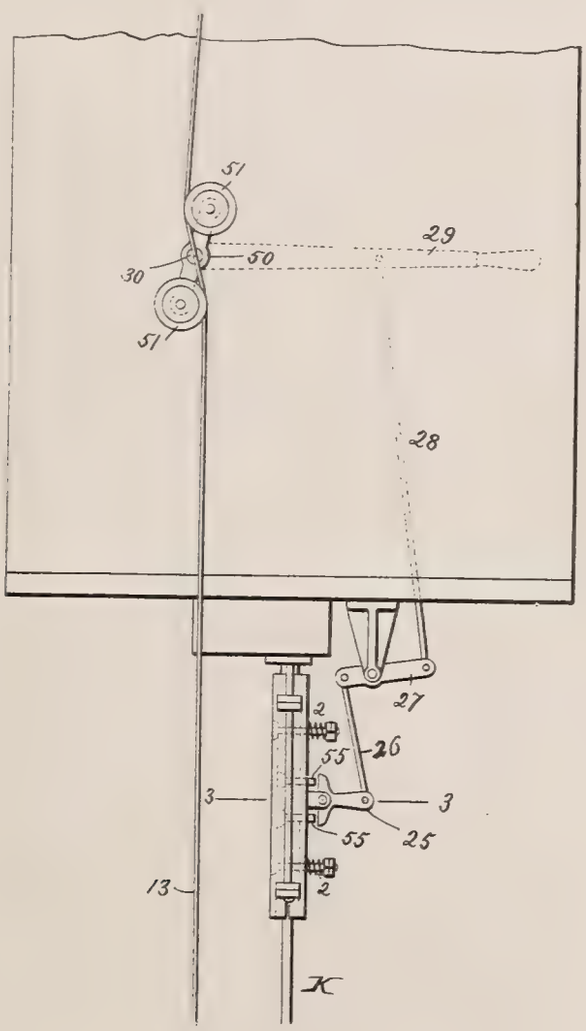
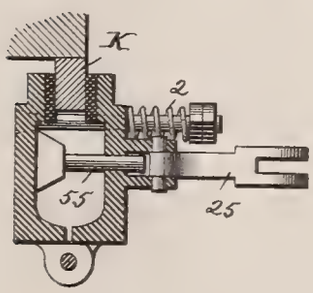


Fig. 3.



Witnesses
Jno. J. Hinkel Jr.
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N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

CYRUS W. BALDWIN, OF YONKERS, NEW YORK, ASSIGNOR TO THE HYDRAULIC ELEVATOR COMPANY, OF CHICAGO, ILLINOIS.

STARTING AND STOPPING DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 416,983, dated December 10, 1889.

Application filed February 18, 1889. Serial No. 300,280. (No model.)

To all whom it may concern:

Be it known that I, CYRUS W. BALDWIN, a citizen of the United States, and a resident of Yonkers, Westchester county, New York, have invented certain new and useful Improvements in Stopping and Starting Devices for Elevators, of which the following is a specification.

My invention relates to that class of controlling devices for elevators in which a brake is used in connection with the stopping and starting device; and my invention consists of certain connections between the operating device within the cage, the stopping and starting device, and the brake, as fully set forth hereinafter, whereby to secure the movement of the stopping and starting device in advance of the application or release of the brake.

In the accompanying drawings, Figure 1 is an elevation in part section showing my improved controlling appliances in connection with a vertical elevator. Fig. 2 is an enlarged view showing the parts in immediate connection with the cage. Fig. 2 is a section on the line 3 3, Fig. 2. Fig. 4 is a view illustrating the application of the appliances in connection with an electrical stopping and starting device.

For the purpose of illustrating my invention I have shown the same in connection with a vertical elevator of the "Baldwin" type, having a cylinder B, piston C, valve device G, circulating-pipes 1 4 5, and supply-pipe 6, communicating directly or through the valve device with the circulating-pipes, as is common in apparatus of such kinds. There is also a cage E, operated from the piston through flexible suspensories, which cage is provided with a brake I, of any suitable construction. As shown, the brake is a clamp-brake having two jaws pivoted and suspended below the cage and adapted to grip the vertical brake bar or guide K, and the jaws are forced against the guide to grip the same by the action of springs 2 2, and are separated by swinging a T-lever 25 in either direction from a central horizontal position, as fully set forth in Letters Patent of the United States granted to me February 22, 1887, No. 358,322, to which reference is made in lieu of a more detailed description of the brake.

The brake is operated from within the cage from any suitable device provided with an operating-handle, as a wheel or lever, to be grasped by the attendant. As shown, there is a handled lever 29, connected by a rod 28 with the arm 27 of a shaft rocking in bearings on the cage, the arm 27 being also connected by a rod 26 with the end of the T-lever 25, and the parts being so arranged that the movement of the handle 29 in either direction from its central position will swing the lever 25 and unclasp the clamp, releasing the brake, while a reverse movement will allow the springs to act to clamp the guide K between the jaws of the brake.

The object of the brake is to coact with the stopping and starting device, whether a belt-shifter, switch, or steam or water valve, so that the brake will aid in reducing the momentum of the cage and hold it finally in a fixed position.

In Fig. 1 the brake is shown in connection with a valve stopping and starting device, the valve and the brake being operated preferably from the same handle through devices which first start the movement of the valve and then apply or remove the brake. Thus the operating-lever 29 is connected to a shaft 30, extending through the cage and carrying an arm 50 outside the cage provided with studs for two grooved pulleys 51 51, between which extends a cable 13, hung from an eye-bolt at the top of the well and connected at its lower end to the end of a lever 10, attached at its opposite end to the stem 9 of the stopping and starting valve G. These parts are so arranged that when the lever 29 is horizontal the pulleys 51 51 will be in the position shown—that is, one of the pulleys will be on each side of the cable, one above the other, and the cable will be bent around the pulleys in such manner that the portion below the pulleys has been drawn upward to hold the lever 10 in its mid-position to close the valve and arrest the movements of the engine. By raising the lever 29 the cable is further drawn up and the valve depressed to

put the circulating-pipes in connection, allowing the water to circulate and the car to descend. By depressing the lever 29 from its mid-position the cable is slackened, the outer end of the lever 10, which is weighted, descends, the valve is raised, and the water escapes from below the piston, and also passes under pressure onto the top of the same, and thus moves down the piston and elevates the cage.

Without provision to the contrary the movement of the operating-handle would apply the brake simultaneously with the opening or closing of the valve. This sometimes leads to abrupt actions and the jolting and jarring of the mechanism. I therefore so connect the handle with the two devices as to secure the lead in the movement of the stopping and starting device, as will be now described. Thus the T-lever 25 is shown in Figs. 1 and 2 arranged out of contact with the bearings 55 55 when in mid-position, so that it can have a limited movement before it makes contact with the said bearings to force apart the jaws, so that the lever 29 swings to a certain extent to start the movement of the valve in one direction or the other before the brake is released or applied. When the hand-lever 29 begins its reverse movement, the cable is operated on to move the valve simultaneously with the first movement of the jaws of the brake; but until the jaws are brought close to the brake-bar they do not act to retard the cage, so that in this movement also the valve operates to control the cage in advance of or leads the brake.

In Fig. 4 I illustrate the arrangement of parts not herein claimed, as it forms the subject of a separate application for Letters Patent, Serial No. 285,200, in connection with a switch for electrically controlling the stopping and starting device. In this case the hand-lever 29 carries two contacts *h i*, connected with conductors *c d*, and there are three stationary contacts *e f g*, connected with conductors *a b*, as shown.

When the contacts *h i* are brought to coincide with the pair of contacts *e f*, a circuit is completed to move the valve in one direction, and when brought to coincide with the pair of contacts *f g* a circuit is completed to move the valve in the opposite direction; but in either case the lever is not in its mid-position, but is slightly inclined from a horizontal line.

The rod 28, instead of being pivotally connected with the lever 29, is provided with a slot *y*, receiving a pin 41 on the lever to permit a limited motion of the latter before moving the rod, so that if the lever is in its mid-position it can be moved to bring either pair of contacts to coincide with those on the lever and start the valve before the pin 41 reaches the end of the slot in either direction, after which the continued movement of the lever operates to move the rod 28 and separate the jaws. On reversing the movement of the lever the contacts are brought to coincide, and the valve started before the brake is moved sufficiently to exert any retarding effect upon the cage.

I have not shown the electric connections with the stopping and starting device, as they form no part of this invention; but the parts described serve to illustrate another application of my invention, whereby from a single operating-handle I am enabled to start the movement of the stopping and starting device, whatever may be its character, in advance of the application or releasing of the brake.

Without limiting myself to the precise construction and arrangement of parts shown, I claim—

1. The combination, in an elevator, of a cage, a stopping and starting device, a brake, and connections between the stopping and starting device and the brake, arranged substantially as set forth, to start the movement of the stopping and starting device in advance of the application or release of the brake, substantially as set forth.

2. The combination, with the cage, stopping and starting device, and brake of an elevator, of an operating-handle connected with the brake and with the stopping and starting device, the arrangement of the parts being such as to secure the lead of the stopping and starting device in operating either to start or stop the cage, substantially as set forth.

3. The combination of the cage, stopping and starting device, and a brake of an elevator, with a hand-lever connected to operate the stopping and starting device, and connected with the brake through connections having a limited play to permit the stopping and starting device to be put in action before the application or release of the brake, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CYRUS W. BALDWIN.

Witnesses:
WM. H. SWENY,
WILLIAM F. HARRIGAN.

(No Model.) 4 Sheets—Sheet 1.

C. E. ONGLEY.

ELEVATOR.

No. 446,137. Patented Feb. 10, 1891.

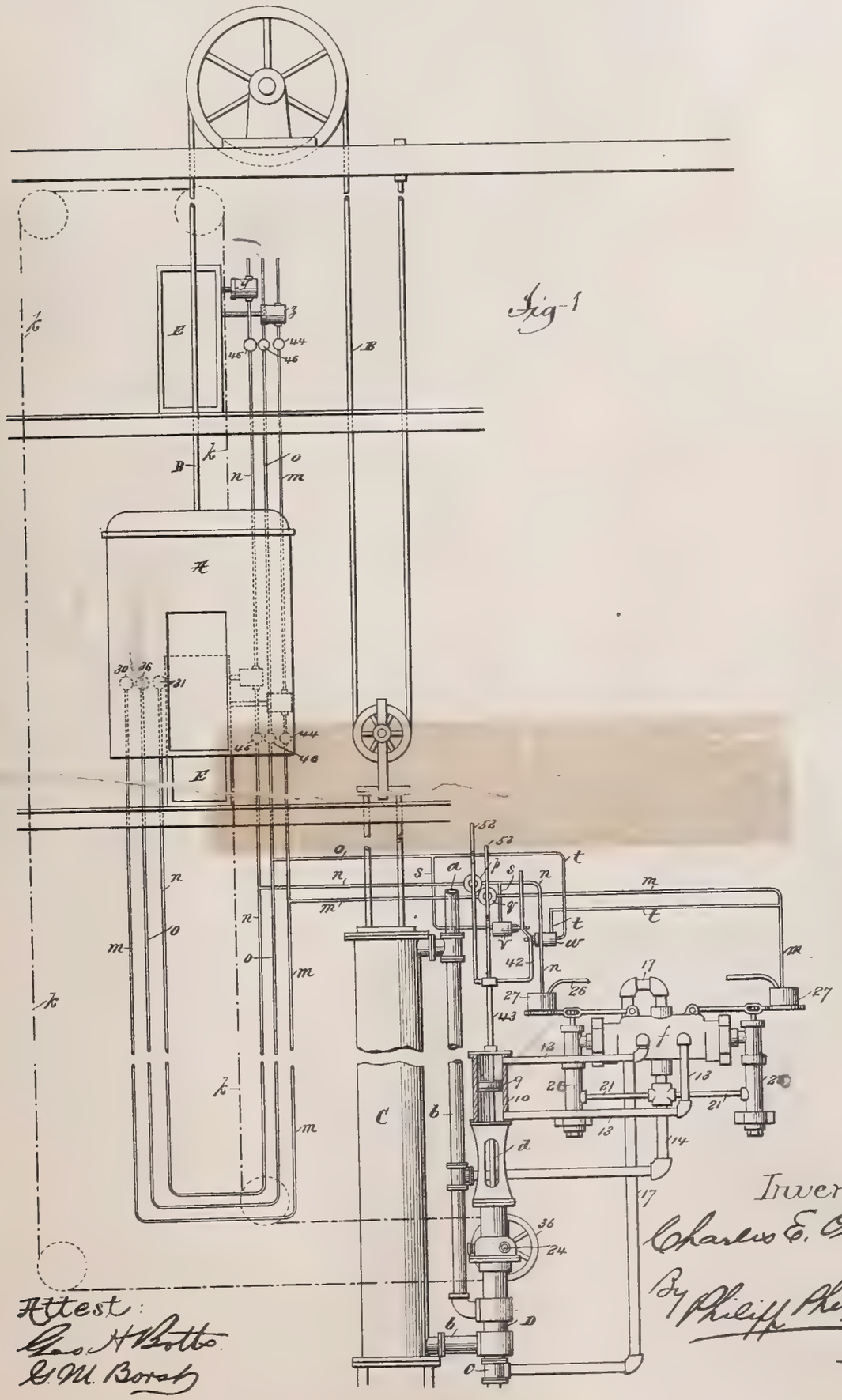

Fig 1

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G. M. Borst

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By Philip, Philip & Hoop
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

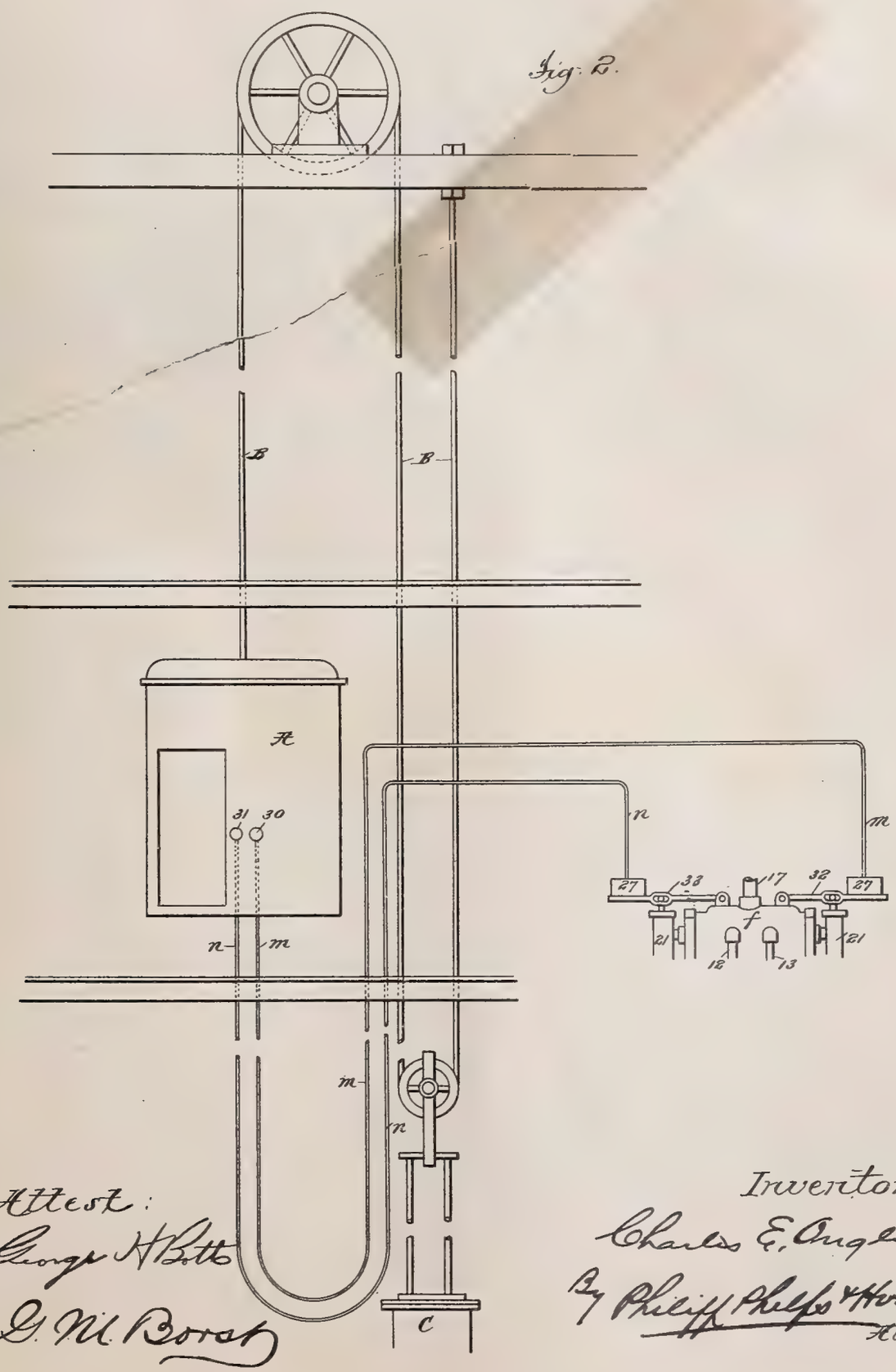
(No Model.) 4 Sheets—Sheet 2.

C. E. ONGLEY.

ELEVATOR.

No. 446,137. Patented Feb. 10, 1891.

Fig. 2.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 3.

C. E. ONGLEY.

ELEVATOR.

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Fig. 3

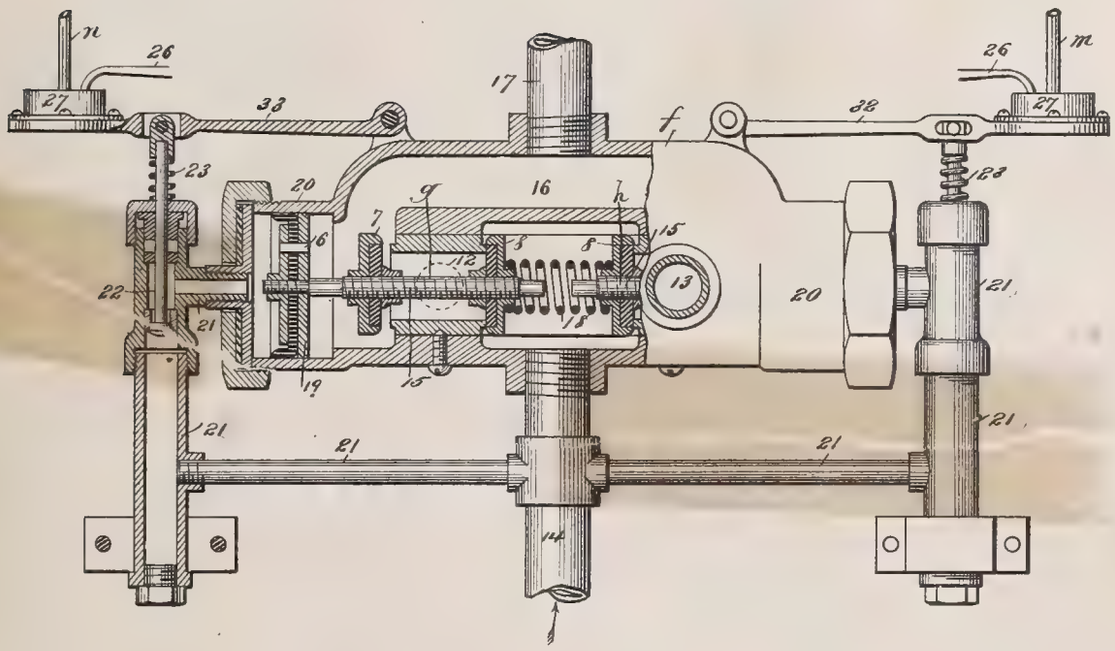


Fig. 5.

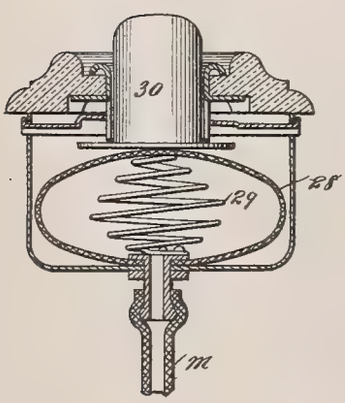


Fig. 6.

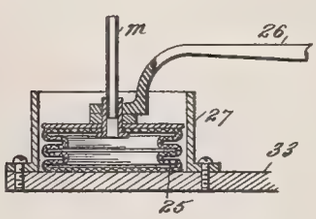
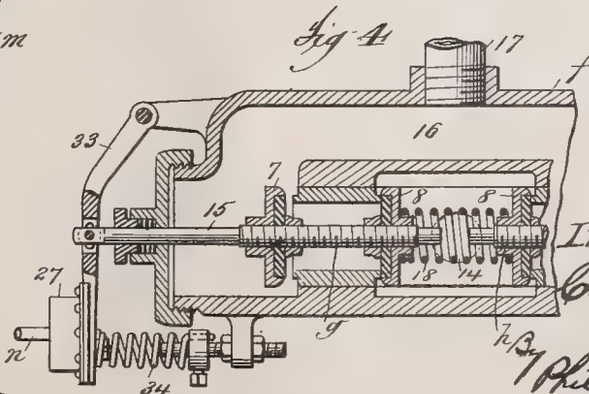


Fig. 4



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(No Model.)

4 Sheets—Sheet 4.

C. E. ONGLEY.

ELEVATOR.

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Fig. 7.

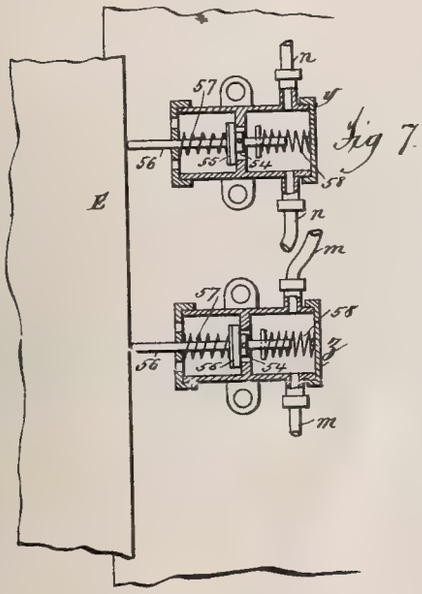


Fig. 8.

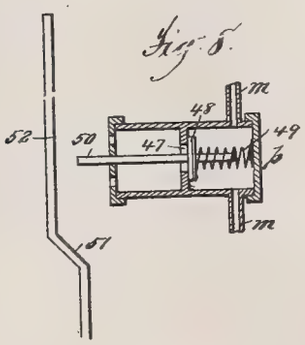


Fig. 9.

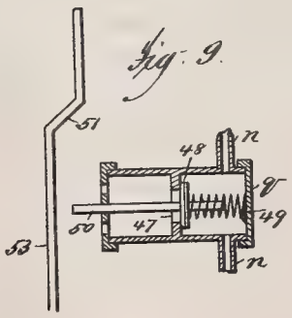


Fig. 10.

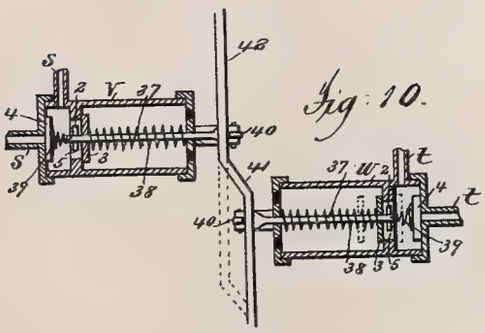
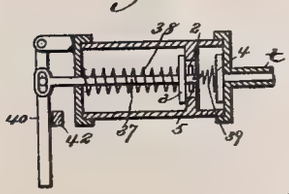


Fig. 11.



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UNITED STATES PATENT OFFICE.

CHARLES E. ONGLEY, OF NEW YORK, N. Y., ASSIGNOR TO THE HYDRAULIC ELEVATOR COMPANY, OF ILLINOIS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 446,137, dated February 10, 1891.

Application filed August 24, 1888. Serial No. 283,606. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. ONGLEY, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in Elevators, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to a means for operating the valve or other mechanism which controls the movements of an elevator by means of pneumatic pressure derived from the car or from the landings or other points from which it is desired to control the movements of the elevator.

The improvement relates particularly to means for operating the auxiliary valves shown in my patent, No. 410,181, dated September 3, 1889, and similar valves, by pneumatic pressure.

One feature of the invention consists in the combination, with the elevator proper consisting of the car, its motor, and the main valve or other mechanism for controlling the movements of the motor, of an auxiliary piston and cylinder for operating the main valve, an auxiliary valve for controlling the movements of the auxiliary piston, a primary cylinder, piston and valve for actuating the auxiliary piston and valve, and pneumatic connections for operating the primary valve from the car or landing.

Another feature of the invention relates to a pneumatic system whereby the main valve is automatically arrested at the middle of its stroke when it is desired to stop the car, whereby it is rendered impossible to start the car until all the doors leading to the elevator-shaft are properly closed, and whereby the main valve is arrested at the proper point at the end of its stroke in each direction, so as to prevent the slamming of the valve.

In order to convey a full understanding of the various features of the invention, the system will now be described in detail, reference being had to the accompanying drawings, in which—

Figure 1 is a diagrammatic view illustrating the system in its most complete form. Fig. 2 is a similar view illustrating the system in its simplest form. Fig. 3 is an enlarged view, partly in section, showing the auxiliary valves and the primary cylinders, pistons, and valves. Fig. 4 is a similar view illustrating an organization in which the primary pistons, cylinders, and valves are omitted. Figs. 5 to 11 illustrate details which will be hereinafter referred to.

Referring to said drawings, it is to be understood that A represents the elevator-car, B the hoisting-cable, and C the motor, consisting of a hydraulic cylinder, these parts being organized in the common and well-known manner. The cylinder C, as herein shown, is arranged vertically; but it may be arranged horizontally, if preferred, as is well understood in the art. The cylinder C is provided with the usual supply-pipe *a*, through which water is admitted to the cylinder under suitable pressure to drive the piston therein, and with the usual circulating and discharge pipes *b c*, by which the water is circulated from the upper to the lower end of the cylinder as the car descends and by which the water is discharged from the bottom of the cylinder as the car ascends. This form of motor is herein shown merely for the purpose of illustrating the application of the present invention. It is to be understood, however, that the invention is not limited in its application to a motor of this form, but may be used in connection with other forms of hoisting apparatus.

The movements of the motor are controlled by means of the main-valve apparatus D, which controls the circulation and discharge of the water in and from the cylinder C. This apparatus will therefore, for convenience, be herein termed the "main valve;" but it is to be understood that this term is herein used in a broad sense and is intended to include any suitable form of mechanism for controlling the motor, which mechanism will of course be modified in different cases to conform to the character of the motor employed. The rod *d* of the main valve D is extended beyond the casing of the valve, and is provided with a piston 9, called, for convenience, an "auxiliary piston," which works in an auxiliary cylinder 10. The cylinder 10 communicates at its opposite ends with two pipes 12 13, which enter a valve-chamber *f*, which also communicates by a pipe 14 with the circulat-

ing-pipe *b*, or with some other source from which water is supplied under a suitable pressure to operate the piston 9 and the main valve. The induction and exhaust of the water to and from the cylinder 10 are controlled by means of two auxiliary valves *g h*, which are located in the casing *f*. Each of these valves consists of two disks 7 8, which are connected to a common rod 15, and are arranged to seat against the ends of chambers into which the pipes 12 13 open between the disks of the respective valves, the disks of the respective valves being so arranged that when the valves are in one position communication is established between the pipe 14 and the pipes 12 13, and that when the valves are in the reverse position communication is cut off between the pipe 14 and the pipes 12 13 and is established between the pipes 12 13 and a duct 16, which communicates with a discharge-pipe 17. The valves *g h* are provided with a spring or springs 18, which is or are so arranged as to normally hold the valves in position to cut off communication between the pipe 14 and the pipes 12 13, and to keep the communication open between the said pipes 12 13 and the pipe 17. In other words, the auxiliary valves are so arranged that they are normally held in such position as to equalize the pressure upon the opposite sides of the piston, and at the same time allow the water to pass out of both ends of the cylinder 10, the purpose being to permit the piston 9 to be moved in either direction. The rods 15 of the respective valves *g h* are extended beyond the disks 7, and are provided with pistons 19, termed, for convenience, "primary pistons," which work in primary cylinders 12. The cylinders 20 are provided with induction-pipes 21, which communicate with the pipe 14, or with some other source through which water is supplied under suitable pressure to operate the pistons 19. The pipes 21 are controlled by primary valves 22, by which the water is allowed to enter the cylinders 20 at the proper times to operate the pistons 19, and through them the valves *g h* to move the piston 9. The valves 22 are normally held in position to close the pipes 21 and prevent the entrance of water to the cylinder 20 by means of springs 23, arranged to act upon the valve stems.

The operation of the system as thus far described is as follows: Assuming that it is desired to cause the car to descend, it is only necessary to depress the primary valve 22, which controls the auxiliary valve *g*, so as to allow water under pressure to pass through the pipe 21 and enter the primary cylinder 20. The water entering the cylinder 20 will act upon the pistons 19 and move the valve *g* against the tension of the spring 18, so as to cause the disks 7 to cut off communication between the pipes 12 17 and the disk 8 open communication between the pipes 12 14. The water will then pass from the pipe 14 into the pipe 12 and enter the cylinder 10 above the piston 9, thus putting greater pressure upon the upper side of the piston and moving it and the connected main valve downward, so as to permit the water to circulate from the upper to the lower end of the cylinder C, and thus permit the car to descend. During this operation the valve *h* will remain in its normal position, so as to maintain communication between the pipes 13 17, so that as the piston 9 is driven downward by the water entering the cylinder 10 through the pipe 12 the water contained in the cylinder below the piston will pass out through the pipe 13 and past the valve *h* to the pipe 17. When the main valve has been shifted to the proper extent, depending upon the speed at which it is desired the car shall move, the valve 22 will be closed, and as soon as the valve is thus closed the spring 18 will restore the valve *g* to its normal position. To permit this the pistons 19 are provided with permanently-open exhaust-ports 6, through which the water contained in the cylinders 20 is allowed to escape as the valves are restored to their normal position by the spring 18. These ports are, however, so small that the water entering through the pipes 21 will not escape with sufficient rapidity to prevent the pressure upon the pistons 19 from moving the valves. To stop the car in its descent or cause it to ascend it is only necessary to depress the other primary valve 22. The auxiliary valve *h* will then operate in the same manner as just described to allow the water to pass from the pipe 14 through the pipe 13 to the lower end of the cylinder 10, and thus drive the piston 9 upward. If it is desired to simply stop the car, the primary valve will be closed as soon as the main valve has arrived at its mid-position, so as to cut off both the circulation and discharge of the water in and from the cylinder C. If it is desired to cause the car to ascend, the primary and auxiliary valves will be kept open until the main valve has been moved upward past its mid-position, so as to allow the water to escape from the lower end of the cylinder C and permit its piston to descend, and thus cause the car to ascend. To stop the car in its ascent the operation is reversed. From this it will be seen that in order to control the movements of the car either from the car itself or from any other point—as, for example, from the landings—it is only necessary to provide means by which the primary valves 22 can be opened at the proper times either from the car or from such other desired point. For this purpose the rods of the primary valves 22 are connected to levers 32 33, which are fulcrumed upon the casing *f*, and are arranged with their free ends in close proximity to an expansible bulb or sack 25, (see Fig. 6,) which is supported upon a rigid arm 26, extending from some stationary part of the machinery or frame-work. The sacks 25 are normally maintained in a collapsed condition; but they are so arranged that when

inflated they press upon the levers 32 33, so as to depress the levers and open the valves 22. The sacks 25 will preferably be arranged to lie within cylindrical cups or casings 27, mounted upon the ends of the levers, as shown; but they may of course be arranged in any other suitable manner. The sacks 25 communicate with small pipes *m n*, which lead from the respective sacks to collapsible bulbs 28, (see Fig. 5,) carried upon the car. The portions of the pipes *m n* which are connected to the bulbs 28 upon the car will be flexible for a sufficient length, as indicated by the depending loops, to allow the car to have the required up-and-down movement in the elevator-shaft. The bulbs 28 are normally held in an inflated condition by means of springs 29, inclosed within the bulbs or by other suitable means. Each of the bulbs is located in a suitable casing or receptacle, and the bulbs are provided with push-buttons 30 31, similar to electrical push-buttons, but having a more extended movement, by which the bulb can be collapsed when desired. The bulbs 28, pipes *m n*, and sacks 25 being filled with air and being so constructed that the air can find no escape, it becomes possible to operate the valves 22 by simply pressing upon the buttons 30 31 upon the car. To illustrate, if the conductor wishes the car to ascend, he will press the buttom 30, and thereby collapse the bulb 28 beneath that button. The air confined in the bulb will thus be forced into the pipe *m* and will force the air out of the pipe into the sack 25, which is arranged above the lever 32, thereby inflating the sack and causing it to press against the lever, so as to depress the same and open the valve 22, which controls the auxiliary valve *h*, and thus cause the car to ascend, as before explained. To cause the car to descend the conductor will press upon the button 31, thereby depressing the lever 33 and operating the valve *g* in the same manner. To stop the car the conductor will press upon the proper button to reverse the main valve, and will release the button in time to arrest the main valve in its mid-position. As soon as pressure is removed from either one of the buttons 30 31 the spring 29 will at once restore the bulb 28 to its inflated condition, thereby allowing the air to pass out of the sack 25, so that the sack will collapse and allow the spring 23 to close the primary valve, which has been opened.

The system as thus far described embodies my invention in its simplest form—that is to say, it provides means by which the car can be caused to move in either direction at any desired speed and can be stopped in any position when moving in either direction, the movements of the car being under the control of the conductor. This is sufficient to meet the requirements in a great number of cases.

I have thus far described the main valve as being operated by an auxiliary piston which is controlled by auxiliary valves, which auxiliary valves are in turn operated by primary pistons controlled by primary valves, which latter are operated by pneumatic pressure from the car. This is the preferred organization, as by this means the power required to be exerted by the pneumatic pressure is reduced to such an extent that a comparatively light pressure and small amount of movement of the push-buttons is all that is required. In some cases, however, it may be preferred to dispense with the primary pistons, cylinders, and valves and operate the auxiliary valves directly. This is perfectly feasible and may be accomplished without wholly departing from my invention by the organization shown in Fig. 4, in which the rods 15 of the auxiliary valves are connected to the levers 32 33, so that the auxiliary instead of the primary valves are operated by the inflation of the sacks 25. In this case the pressure required to operate the levers 32 33 may be reduced by providing the levers with springs 34, which act in opposition to the spring 18, and are provided with means by which their tension can be adjusted, so as to nearly, but not quite, overcome the tension of the spring 18. By this means the valves *g h* can be nearly balanced, so that a comparatively light pressure will be sufficient to move them. The speed of the car cannot, however, be so easily controlled by this organization as by that first described.

In addition to the system for controlling the movements of the main valve D by means of pneumatic connections from the car, it may in some cases be desirable to provide the elevator with means by which the main valve can be operated mechanically from the car, so as to give the conductor positive control of that valve and of the movements of the elevator in case for any reasons the pneumatic connections become disordered or fail to operate properly. The organization of the auxiliary-valve apparatus which has been described, by allowing the water to pass freely out of both ends of the cylinder 10, permits this, and for this purpose the rod *d* of the main valve is provided with the usual rack, which engages with a pinion mounted upon a shaft 24, having a pulley 35, around which passes an ordinary hand-rope *k*, which passes around pulleys arranged in the usual manner and extends up and down the wall and through the car in position to be grasped by the conductor. In the usual working of the elevator this hand-rope will simply remain idle and be moved around its pulleys by the rack and pinion as the main valve is moved by the piston 9. If, however, the pneumatic system becomes disordered or fails to operate, the conductor can by using the hand-rope have positive control of the valve and of the movements of the car.

It has been explained how by operating the buttons 30 31 the conductor can cause the car to ascend or descend or be stopped in any position. In order to stop the car in any po-

sition, it is necessary, however, in the system as thus far described, that the conductor should release the button 30 or 31, as the case may be, as soon as the main valve has arrived at its mid-position and stopped the car, as if the pressure is not removed from the button immediately upon the main valve arriving at its mid-position the valve will continue to move and pass its mid-position, and thus reverse the movement of the car. If the conductor is skillful and attentive, this need not occur, as he will be able to release the button at the proper time to arrest the valve in the proper position. If, however, the conductor is unskillful or inattentive, this may occasion some annoyance, and to avoid this the system, as illustrated in Fig. 1, is provided with means by which, when it is desired to arrest the car at any point, the main valve will be automatically stopped in its mid-position. For this purpose the car is provided with a third push-button 36 and bulb 28, which is connected with a pipe *o*, similar to the pipes *m n* and having branches *s t*, which connect, respectively, with the pipes *n m*.

The branches *s t* are controlled by valve apparatuses *v w*, which are arranged as follows: Each of the valve apparatuses *v w* (see Figs. 10 and 11) consists, primarily, of a small chamber, which is included in the respective branches *s t*. Each of these chambers is provided with a port 5 and with two valves 3 4, the former of which controls the port 5, while the latter controls the pipe *s* or *t*, as the case may be, when the valve is in one position and the port 5 when it is reversed. The valve 3 is arranged to move freely on its stem 37 and is pressed to its seat by a spring 38, it being moved away from its seat by a pin 2 inserted in the stem. The valve 4 is pressed to its seat when in either position by a spring 39 secured to the end of the stem 37. By this means it will be seen that a certain amount of lost motion is permitted between the valves and their stems 37, which permits the stem to be moved slightly in either direction after either or both of the valves have been carried to their seats. The stems 37 are connected to levers 40, which are arranged to be acted upon by reversely-arranged shoulders 41, formed upon a rod 42, which is carried by an extension 43 of the valve-rod *d*, or by any other moving part of the elevator which moves in harmony with the main valve. The shoulders 41 are so arranged with relation to the levers 40 that when the main valve is in its mid-position the levers 40 will be allowed to move to such position as to permit the valves 3 4 to close the ports 5 and branches *s t*, as shown in Fig. 10, and thus cut off communication between the pipe *o* and both the pipes *m n*. The shoulders 41 are, however, so arranged that when the main valve is moved downward from its mid-position, so as to cause the car to descend, the shoulder 41, acting upon the lever 40 of the apparatus *w*, will move the valve-stem 37 so as to move the valve 3 away from the port 5 and at the same time move the valve 4 so as to open the branch *t* and into position to close the port 5, as indicated by dotted lines in Fig. 10. It will readily be seen, therefore, that when the parts are in this position communication is established through the branch *t* between the pipes *o m*, the branch *s* remaining closed, so as to shut off communication between the pipes *o n*. When the main valve is moved upward from its mid-position, the operation is reversed, and the other shoulder 41, acting upon the lever 40 of the apparatus *v*, operates similarly to shift the valves 3 4 of that apparatus, so as to establish communication through the branch *s* between the pipes *o n*, while the branch *t* remains closed, so as to cut off communication between the pipes *o m*.

The operation of this part of the system is as follows: Assuming the car to be descending and that it is desired to stop the car at a given landing, the conductor will, when the car arrives at the proper distance from the landing, press the button 36. This will press the bulb 28 beneath that button and force the air out of the bulb into the pipe *o*. The car being, as assumed, descending, the valve D will be below its mid-position, and as a consequence the rod 42 will be moved downward, so that the shoulder 41, acting upon the lever 40, will have moved the valves 3 4 of the apparatus *w* to the position shown by dotted lines in Fig. 10, so as to establish communication between the pipes *o m* through the branch *t*, while the valves of the apparatus *v* will remain in the position indicated in Fig. 10, so as to cut off communication through the branch *s*. The air forced into the pipe *o* cannot therefore find an escape through the branch *s*, and will be forced through the branch *t* to the pipe *m*, and will therefore operate to inflate the sack 25 and operate the lever 32, and through it the primary and auxiliary valves, so as to reverse the main valve and cause it to ascend. As soon, however, as the main valve arrives at its mid-position upon its ascent the shoulder 41 will pass out of engagement with the lever 40 of the apparatus *w*, thereby allowing the valves 3 4 to move to the position shown by full lines in Fig. 10, so as to cut off communication through the branch *t*. As the valves thus move from the position shown by dotted lines in Fig. 10 to the position shown by full lines, there will be a short time in which the port 5 will be open to the atmosphere, and during this period the pressure in the pipes *o t m* will be relieved, so as to allow the sack 25 to collapse and the primary and auxiliary valves to close, and thus arrest the main valve in its mid-position, no matter whether the conductor releases the button 36 at the proper time or not. When the car is ascending and it is desired to arrest it at any point, the operation will be exactly the same, except that in such case the main valve being above its mid-position communication will be shut off

through the branch *s*, so that upon pressure being applied to the button 36 the air will be forced into the pipe *n*, so as to operate the lever 33 and cause the main valve to move downward to its mid-position.

It is in many cases desirable to provide means by which the movements of the car can also be controlled from any one of the several landings, so that where no conductor is employed a person at any landing can bring the car to that landing and stop it in proper position for ingress or egress. When this is desired, it can readily be accomplished in the manner indicated in Fig. 1. For this purpose the pipes *m n o* are extended to the several landings and are provided at each landing with push-buttons 44 45 46, corresponding to the buttons 30 31 36, which act upon bulbs which communicate with the respective pipes the same as the bulbs upon the car.

The operation of controlling the movements of the car from any one of the several landings is exactly the same as already described.

In operating elevators of this class it is desirable to provide means by which the main valve will be arrested before it reaches the extreme limit of its movement, so as to avoid the effects which would result from the slamming of the valve. Where the valve is operated by the ordinary hand-rope, this is usually accomplished by causing the rope to pass through a stationary guide and providing the rope with stops located at a suitable distance upon either side of the guide, which by coming into contact with the guide will arrest the rope before it has been moved sufficiently to slam the main valve. For the purpose of accomplishing the same result in the present system, the pipes *m n* are provided with automatic escape-valves, which operate to automatically relieve the pressure in the respective pipes just before the main valve reaches the limit of its movement in either direction, and thus arrest the valve. These valves are contained in small chambers *p* and *q*, (see Figs. 8 and 9,) with which the pipes *m n* respectively communicate. These chambers are provided with ports 47, which are controlled by valves 48, which are normally held in position to close the ports by means of springs 49, and thus prevent the escape of the air from the pipes. The valves 48 are provided with stems 50, which are acted upon by reversely-arranged shoulders 51, formed upon rods 52 53, which are carried by the extension 43 of the valve-rod *d*, or by any other part of the elevator which moves in harmony with the main valve. The shoulders 51 are so arranged that so long as the main valve is in any position intermediate of the desired limit of its movement in each direction the valves 48 will remain closed to prevent the escape of the air from the pipes *m n*, and thus permit the valve to be operated. The shoulder 51 of the rod 53 is, however, so arranged that as the main valve arrives at the desired limit of its downward movement it will come into engagement with the stem 50 of the lower valve and move the valve 48 so as to open the port 47, and thus allow sufficient air to escape from the pipe *n* to relieve the pressure in the pipe and permit the sack 25 to collapse and the lever 33 to rise, so as to close the primary and auxiliary valves and arrest the main valve. The shoulder 51 of the rod 52 is so arranged that as the main valve reaches the desired limit of its upward movement it will act upon the stem 50 of the upper valve and allow the air to escape from the pipe *m* with the same result. When either of the valves 48 is thus opened to automatically arrest the main valve at the limit of its movement in one direction, the other valve remains closed, so that the primary and auxiliary valves which act to reverse the movement of the main valve are in condition to be operated. It is also desirable in elevators of this class, and particularly in the case of those that are used for carrying passengers, to provide means by which it will be impossible to start the car from any landing until the door opening from the landing to the elevator-shaft has been closed, thereby providing a safeguard against accidents, caused by persons entering the door when the car is not present in front of it. For this purpose the pipes *m n* are provided with valves (see Fig. 7) located at each landing, and so arranged that whenever any one of the doors E leading to the elevator-shaft is not properly closed the valves will be open, so as to allow the escape of the air from the pipes *m n*, and thus prevent the operation of either one of the levers 32 33 and the starting of the car in either direction until the door has been properly closed. These valves are located in chambers *y z*, which communicate with the respective pipes *m n*, and are provided with ports 54, which are controlled by valves 55, the stems 56 of which are in position to be engaged by the door E, so as to cause the valves 55 to close the ports 54 when the door is closed, as shown in Fig. 7. The valves are provided with springs 58, which act whenever the door is moved away from the stems 56 to open the valves, and thus afford free communication between the atmosphere and the pipes *m n*. The valves 55 are made to slide freely in one direction upon their stems, and are provided with springs 57, by which they are pressed against their seats, so as to close the ports 54 whenever the stems are moved inward by the door. This allows the stems 56 to have a limited amount of movement after the valves have been forced against their seats, and thus compensate for slight variations in the position of the door when closed.

The term "bulb" as applied to the collapsible and expansible devices which are operated upon by the push-button upon the car and at the landings is herein used in a broad sense, and is to be understood as in-

cluding not only the specific form of expansible device shown, but any other form of apparatus which will perform an equivalent function—that is to say, any apparatus which will operate through the pressure upon the button to exert a pressure upon the column of air contained in the pipe. So, also, the term "sack" as applied to the expansible and collapsible devices 25, which act through the medium of the levers 32 33 to operate the primary or auxiliary valves, is used in a similar sense, and is to be understood as including not only the specific form shown, which is the preferred form, but also any other form which will perform the same function—that is to say, will expand so as to exert a pressure to be transmitted to the valves when the air-pressure in the pipe is raised above its normal point.

What I claim is—

1. The combination, with an elevator-car, its motor, and the main valve for controlling the movements of the motor, of an auxiliary cylinder, piston, and valve for operating the main valve, a primary cylinder, piston, and valve for operating the auxiliary valve, an expansible sack for operating the primary valve, and a pneumatic pipe connecting said sack with a bulb, substantially as described.

2. The combination, with an elevator-car, its motor, and the main valve for controlling the movements of the motor, of an auxiliary cylinder, piston, and valves for operating the main valve, primary cylinders, pistons, and valves for operating the auxiliary valves, expansible sacks for operating the primary valves, and pneumatic pipes connecting said sacks with bulbs, substantially as described.

3. The combination, with an elevator-car, its motor, and the main valve for controlling the movements of the motor, of pneumatic pipes through which the movement of the main valve in opposite directions is controlled by air-pressure, and valves 48, controlling said pipes and operated by a moving part of the elevator mechanism to allow the air to escape from the respective pipes as the main valve reaches the limit of its working movement in opposite directions, substantially as described.

4. The combination, with an elevator-car, its motor, and the main valve for controlling the movements of the motor, of a pneumatic pipe having branches for controlling the movements of the main valve in opposite directions by air-pressure, valves controlling said branches and operated by a part of the mechanism moving in harmony with the main valve, and said valves opening communication through one of said branches when the main valve is near the end of its stroke and closing communication through both of said branches when the main valve is at the middle of its stroke, as described.

5. The combination, with an elevator-car, its motor, and the main valve for controlling the movements of the motor, of a pneumatic pipe through which the movement of the main valve is controlled by air-pressure, valves 55, controlling said pipes and having an escape-opening, and doors of the elevator-shaft in operative connection with said valves 55 to open said escapes by the opening of the doors and close said escapes by the closing of the doors, as described.

6. The combination, with an elevator-car, its motor, and the main valve for controlling the movement of the motor, of an auxiliary cylinder and piston for operating the main valve, an auxiliary valve for controlling the same and having an open exhaust in free communication at all times with an end of the auxiliary cylinder, an expansible sack for actuating the auxiliary valve, a pneumatic pipe connecting the said sack with a collapsible bulb, and a rope *k*, connected to operate the main valve from the car, as described.

7. The combination, with an elevator-car, its motor, and the main valve for controlling the movements of the motor, of an auxiliary cylinder and piston for operating the main valve, auxiliary valves for controlling the same so set that the exhaust-passages from the auxiliary cylinder are open in all positions of the valve, in order to allow the water to pass out of the auxiliary cylinder and permit the auxiliary piston to be moved in either direction, expansible sacks for actuating the respective auxiliary valves, pneumatic pipes connecting said sacks with collapsible bulbs, and a rope *k*, connected to operate the main valve from the car, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES E. ONGLEY. [L. S.]

Witnesses:
OSMAR D. BALLERT,
W. F. MOODY.

(No Model.) 2 Sheets—Sheet 1.

A. SUNDH.

ELEVATOR.

No. 446,397. Patented Feb. 10, 1891.

Fig. 1.

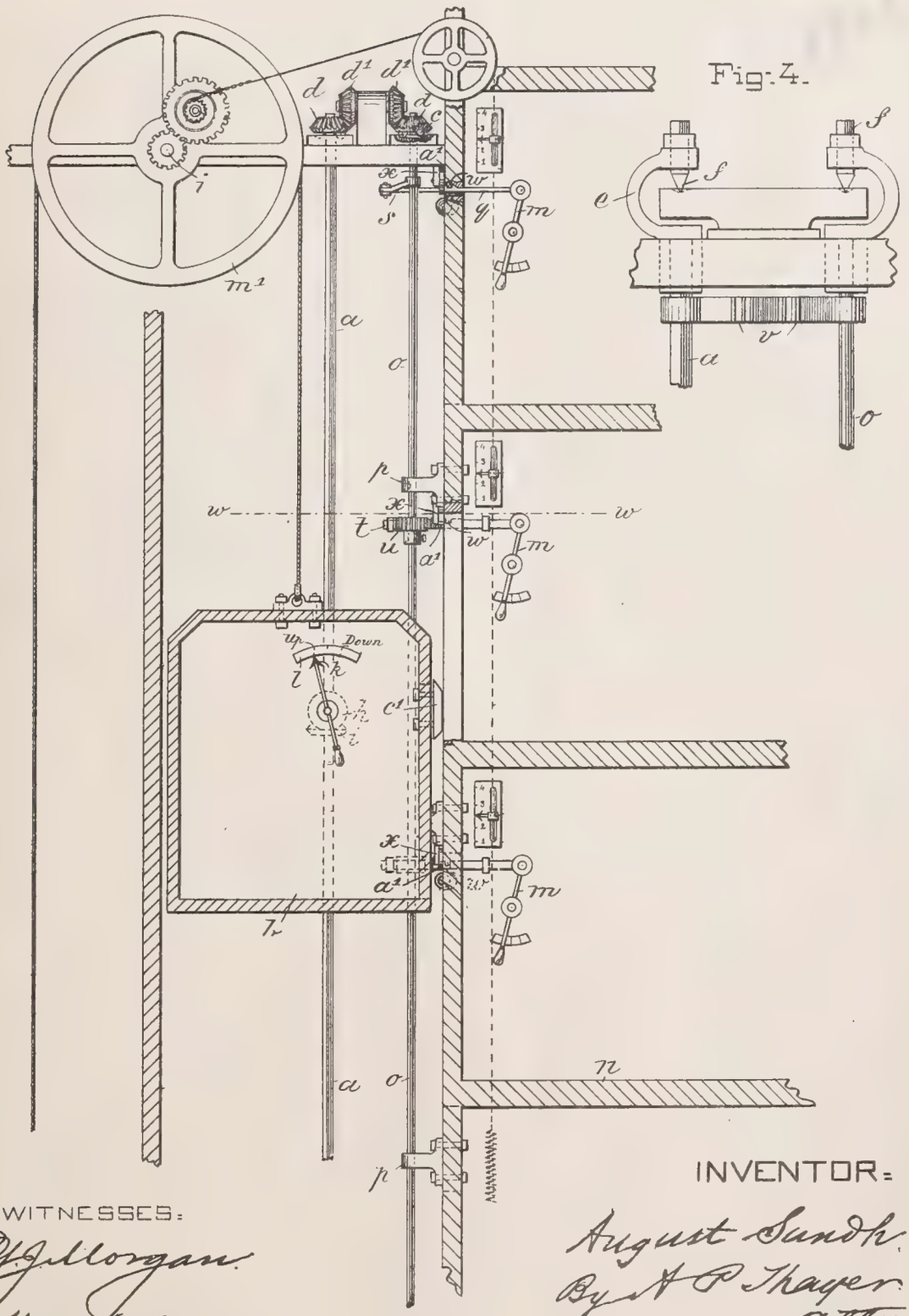

Fig. 4.

WITNESSES:

W. J. Morgan.

W. P. Ezell

INVENTOR:

August Sundh.

By A. P. Thayer

atty.

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(No Model.) 2 Sheets—Sheet 2.

A. SUNDH.

ELEVATOR.

No. 446,397 Patented Feb. 10, 1891.

Fig. 2.

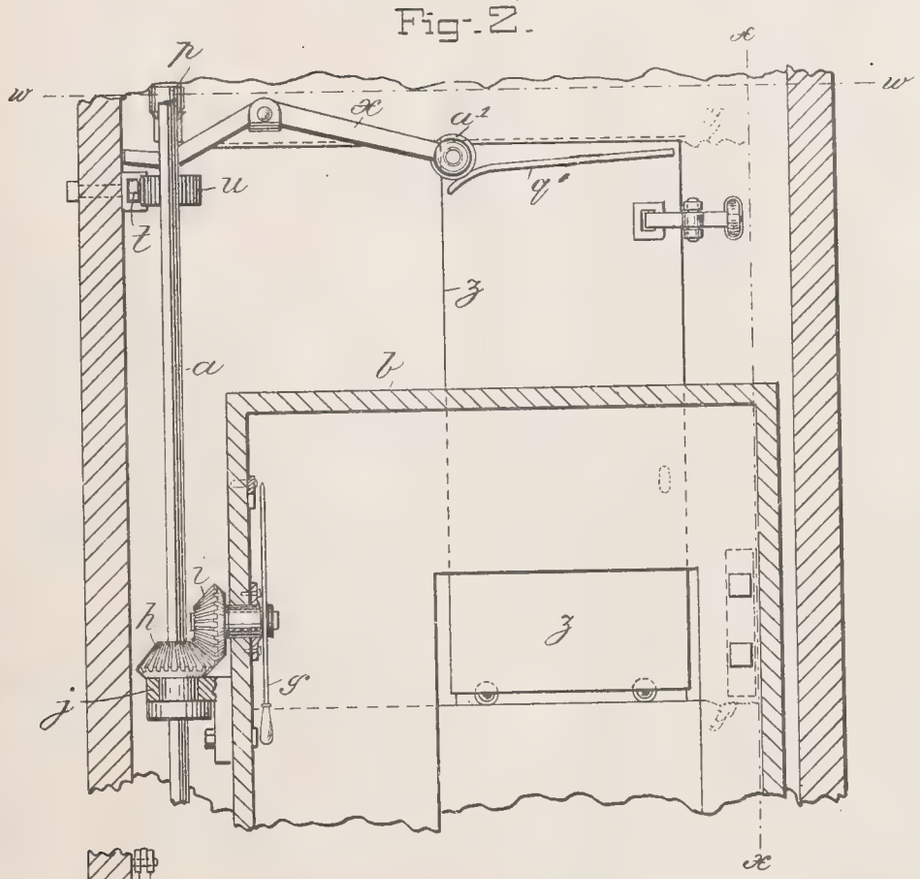
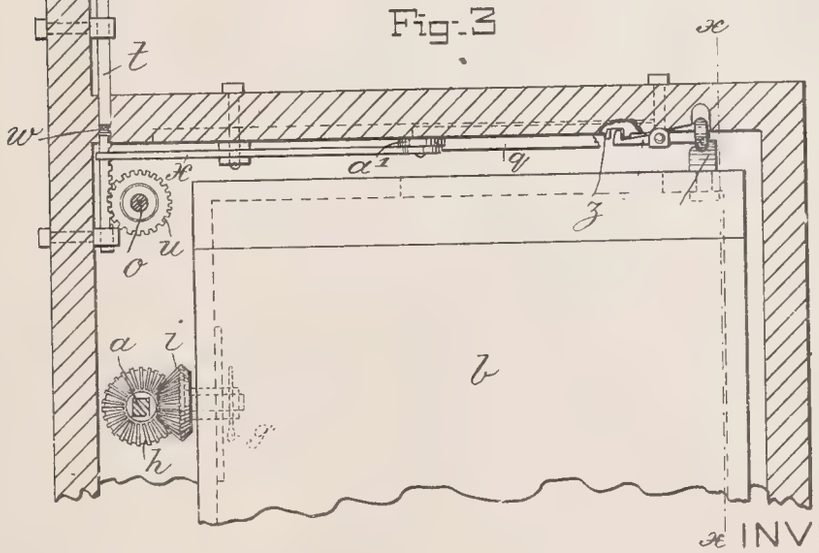


Fig. 3



INVENTOR:

August Sundh
By A P Thayer
Atty

WITNESSES:

C. F. Morgan
W. B. Ball

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UNITED STATES PATENT OFFICE.

AUGUST SUNDH, OF YONKERS, NEW YORK, ASSIGNOR OF ONE-HALF TO ERNEST BOENING, OF SAME PLACE.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 446,397, dated February 10, 1891.

Application filed March 28, 1890. Serial No. 345,675. (No model.)

To all whom it may concern:

Be it known that I, AUGUST SUNDH, a citizen of Sweden, and a resident of Yonkers, in the county of Westchester and State of New York, have invented new and useful Improvements in Elevators, of which the following is a specification.

My invention relates to passenger-elevators for dwelling-houses; and it consists, first, in improved means for working the controlling valve-rod by the operator in hydraulic elevators in the car; also, for working the rod with facility by a person on any one of the floors of the building, as well as in the car, for greater convenience in buildings not having a special conductor for the car.

It consists, second, of an automatic locking device to insure the retention of the car at the door of the elevator-way until the door is closed, all as hereinafter fully described, reference being made to the accompanying drawings, in which—

Figure 1 is a sectional elevation of an elevator-way, car, and parts of several floors of a building, illustrating my invention, the section being taken on the line *x x*, Figs. 2 and 3, with a part broken out on lines *y*, Fig. 2. Fig. 2 is a sectional elevation of part of the same on line *z z*, Fig. 1, on an enlarged scale. Fig. 3 is a horizontal section on line *w w*, Fig. 1, also on an enlarged scale; and Fig. 4 is a detail inside elevation showing a modified arrangement of some of the parts.

I propose to employ the vertical shaft *a*, instead of the rope commonly used for working the regulating-valve of the hydraulic apparatus, from the car *b*, by the conductor, said shaft being suspended from the top of the elevator-way by any approved means and extending down to the hydraulic apparatus and connected in my approved way with the controlling-valve; but this connection I do not represent in the drawings, as it forms no part of the invention to be claimed herein. In this case I have represented said shaft as suspended on anti-friction balls *c* under the bevel-wheel *d* at the top, or it may be by the yoke *e* and pivot *f*. It is thus suspended in preference to supporting it by a step at the bottom, because it would in such case spring and wabble, owing to its great length and small size, or would have to be stayed laterally by bearings contrived to shift away from the shaft to allow the car to pass and return again, which it is highly desirable to avoid, because such bearings must of necessity be rather complicated and expensive, besides not being very reliable. Such lateral bearing-stays may be and have been employed in an arrangement of them in such small size and applied to such small journals of the shaft as to enable a wrench-shaped lever device on the car for turning the shaft to slide past the bearings; but the shaft has to be larger in such arrangement than is required in my plan, in order that the journals shall have sufficient size for torsional strength. Said shaft is geared with the conductor's hand-lever *g*, pivoted to the inside of the car by the bevel-pinions *h i*, the former being carried along the shaft in the bracket *j*, attached to the side of the car, and the latter being attached to the lever-pivot. The lever has a pointer *k*, which traverses an indicator-scale 1, showing the directions for working the carriage up or down. The shaft is angular in cross-section, and the hole in the pinion *h* is the same for allowing the pinion to shift freely along the shaft, and at the same time enabling the pinion to turn the shaft as desired. This means of working the controlling-valve is considered advantageous as compared with the rope commonly used, because it is easier for the conductor to work the lever than to pull the rope up and down; but the chief purpose of the shaft is to provide for coupling with other working-levers *m* in the different stories of the building, so that a person on any one of the floors *n* may have command of the car to bring it to his service without the aid of a conductor. To this end I provide another shaft *o*, extending along the elevator-way and supported in bearings *p* at suitable intervals and coupled in any approved way with said levers, as by the connecting-rod *q* and crank *s* or the toothed rack *t* and pinion *u*, for shifting it by them, said shaft being geared at the top, as by the bevel-pinions *d d'*, spur-gears *v*, or other means for transmitting the motion from the levers *m* individually to the controlling-valve. This shaft is also represented as suspended in like manner as the other; but as it is stayed at in-

tervals by the bearings p it may, if desired, rest on a step at the bottom. Thus the car is alike subject to the control of persons on the different floors as well as in the car, and thus may be practically useful to all the occupants of a building without the expense of a special conductor; but the arrangement has also another advantage in affording a means of automatically locking the valve-operating shaft when the door of the elevator-way opens and keeping it locked while the door remains open for safety to unskilled persons using the elevator. This is accomplished by providing a notch w in the connecting-rod q or rack-bar t and a latch x, pivoted to the wall in such relation to each other that when the working-levers stand on the center position and the elevator is stopped said latch will swing into the notch and providing the inclined flange q' on the door z in such relation to the latch that when the door opens it will shift the latch and engage it with the notch, and thus lock the valve-working gear and effectually prevent starting the elevator while the door is open, and thus insures the closing of the door. The closing of the door releases the latch from the control of the flange and allows the latch to return to the normal position by the overbalancing gravity of the arm acted on by the flange, or it may be a spring, and thus prevents the shifting of the valve-shaft to start the elevator again. The latch has an anti-friction roller a' to roll on the flange for easy action.

Although I have represented the shaft a as arranged in the space between the car and the wall of the elevator-way, which is the arrangement that I prefer, I may of course have it extended through the car as the rope of the common arrangement does, and I do not limit myself to the arrangement shown.

I am aware that it is not a new device broadly to provide anti-friction bearings to sustain lengthwise thrusts on a shaft, as in the case of the screw-shaft of a baling-press, subject to excessive thrust lengthwise, and I do not claim such arrangement. My purpose is to combine such device with the vertical valve-controlling shaft and appliances connecting the same with the car of an elevator, where such shaft must of necessity be too long and slender to keep its alignment without intermediate bearings if supported in a step and where such bearings are impracticable.

What I claim, and desire to secure by Letters Patent, is—

1. The combination, with the elevator-car, of the shaft for working the controlling-valve suspended in the elevator-way from an anti-friction support at the upper end and independently of intermediate bearings along the elevator-way, the working-lever pivoted to the inside of the car, and the bevel-wheels mounted on the car and gearing said lever and shaft together, one of said wheels sliding along the shaft, substantially as described.

2. The combination, with the elevator-car, of the shaft for working the controlling-valve suspended in the elevator-way and geared with the conductor's working-lever in said car, the intermediate shaft also arranged in the elevator-way and geared with the valve-working shaft, and a working-lever in each story geared with said intermediate shaft and through it with the valve-controlling shaft, substantially as described.

3. The combination, with the working-lever mechanism for shifting the valve-controlling rod, of the safety-stop consisting of the notched rod or bar connecting the working-lever with the intermediate shaft, the stop-latch, and the inclined flange on the door of the elevator-way, said stop-latch being automatically detachable from the notched bar when the door is closed, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 20th day of March, 1890.

AUGUST SUNDH.

Witnesses:
W. J. MORGAN,
ERNST LUNDGREN.

(No Model.) 14 Sheets—Sheet 1.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

Fig. 2.

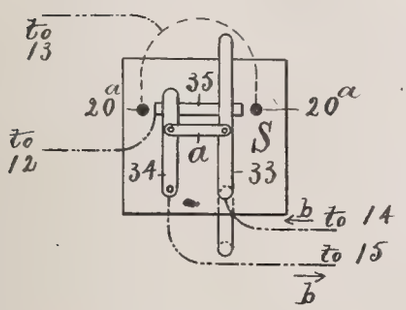


Fig. 1.

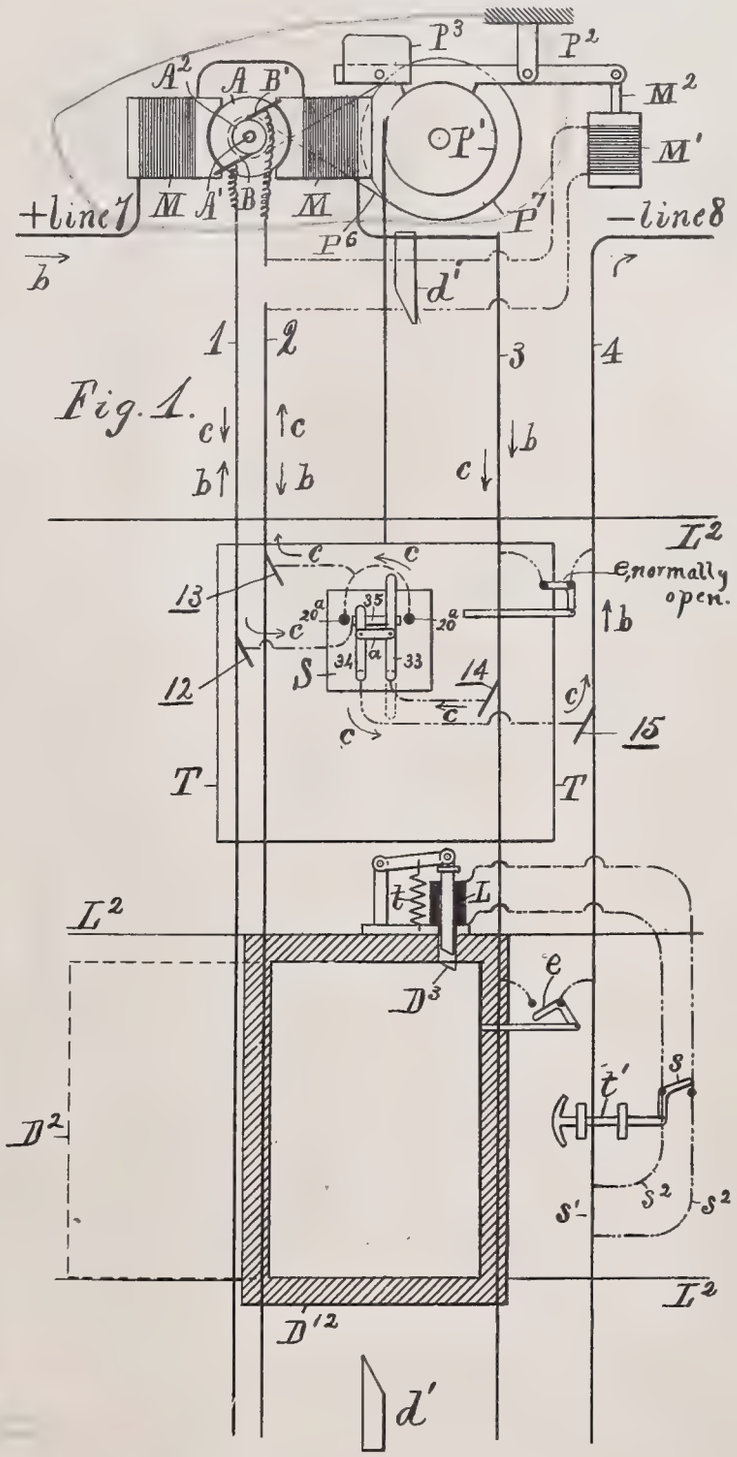
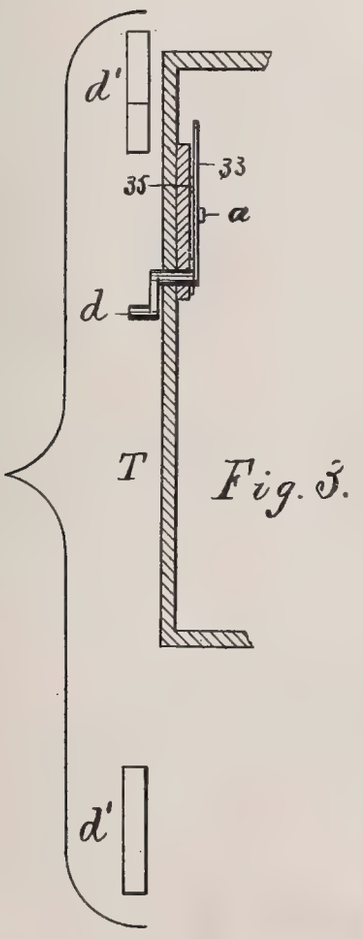


Fig. 3.



Attest.
L. Lee.
F. C. Fischer

Inventor.
William Baxter, Jr.,
per Crane & Miller, attys.

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(No Model.) 14 Sheets—Sheet 2.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

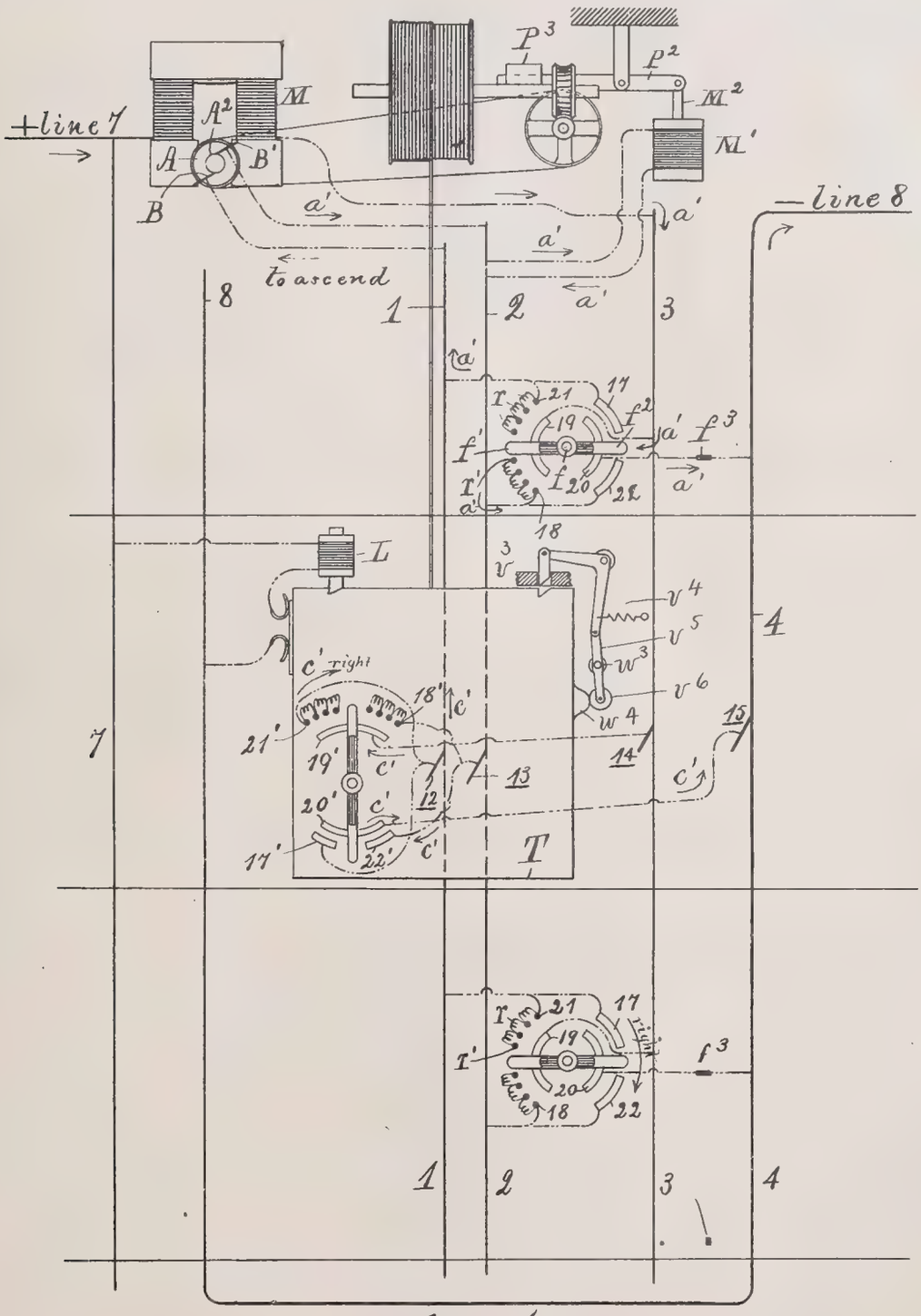

Fig. 4.

Attest.
L. Lee.
F. C. Fischer.

Inventor.
William Baxter, Jr.,
per Crane & Miller, attys.

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(No Model.) 14 Sheets—Sheet 3.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

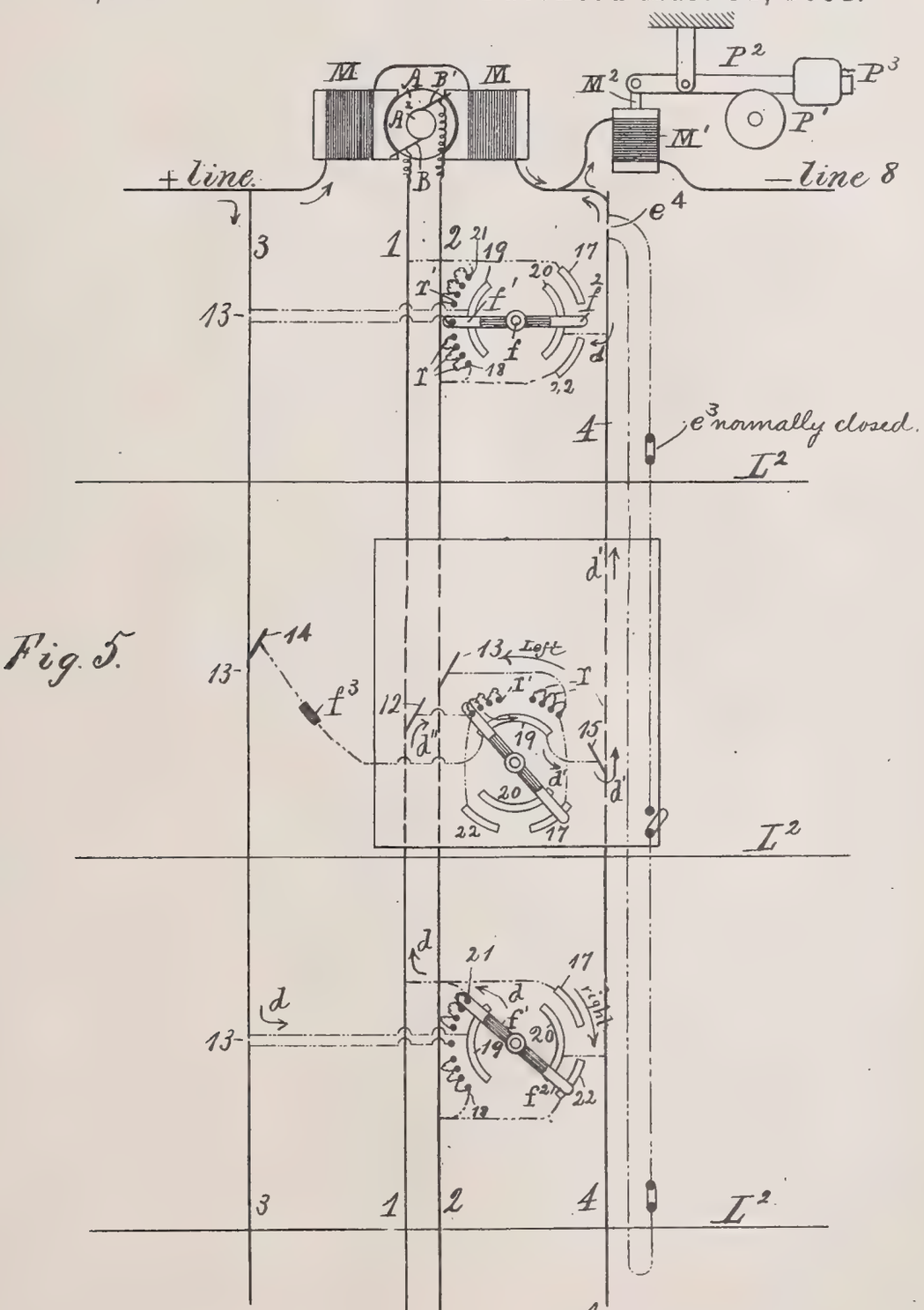

Fig. 5.

Attest:
L. Lee.
F. C. Fischer.

Inventor.
William Baxter, Jr.,
per Crane & Miller, Attys.

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(No Model.) 14 Sheets—Sheet 4.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

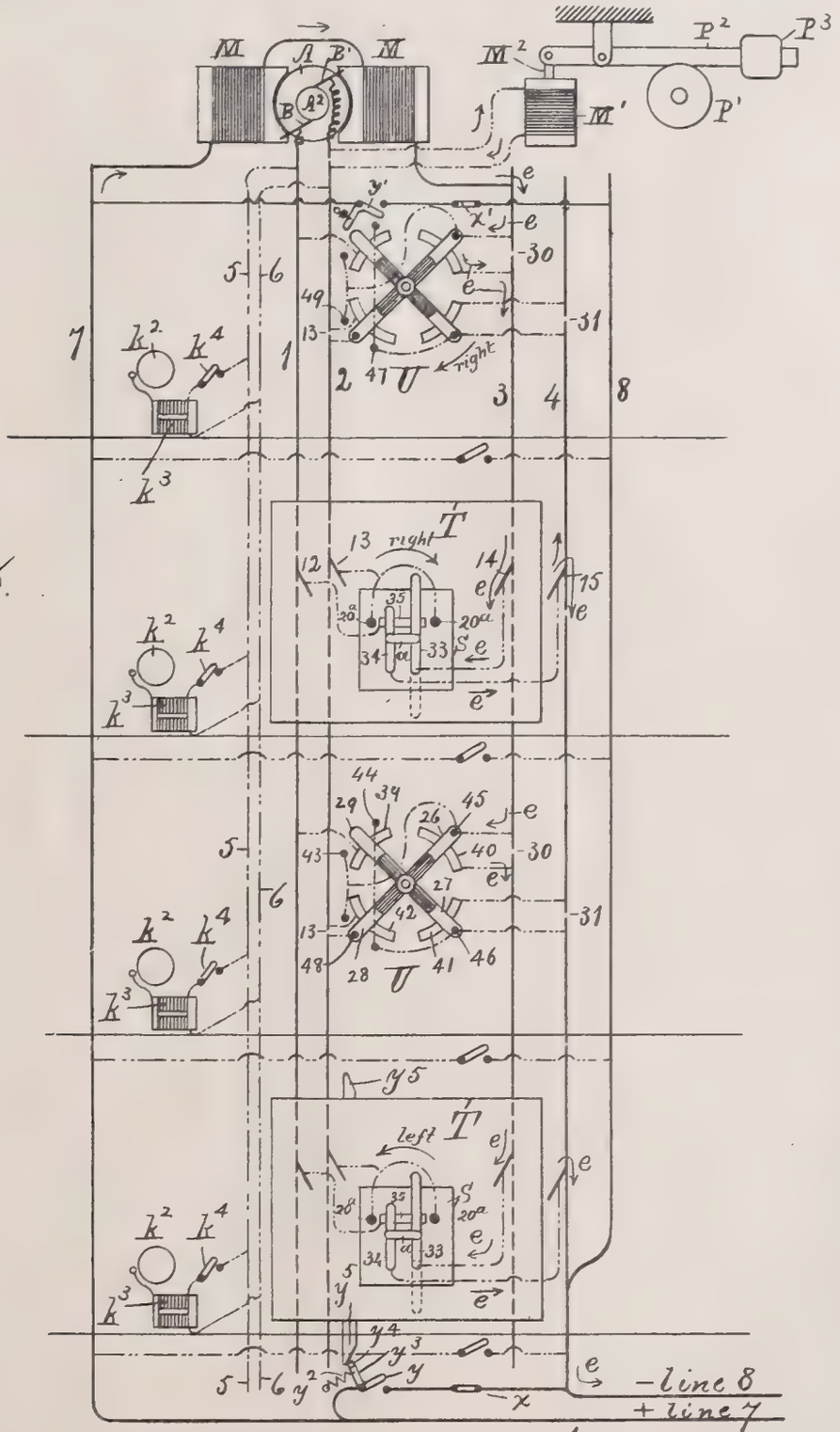

Fig. 6.

Attest:
L. Lee.
F. C. Fischer.

Inventor.
William Baxter, Jr.,
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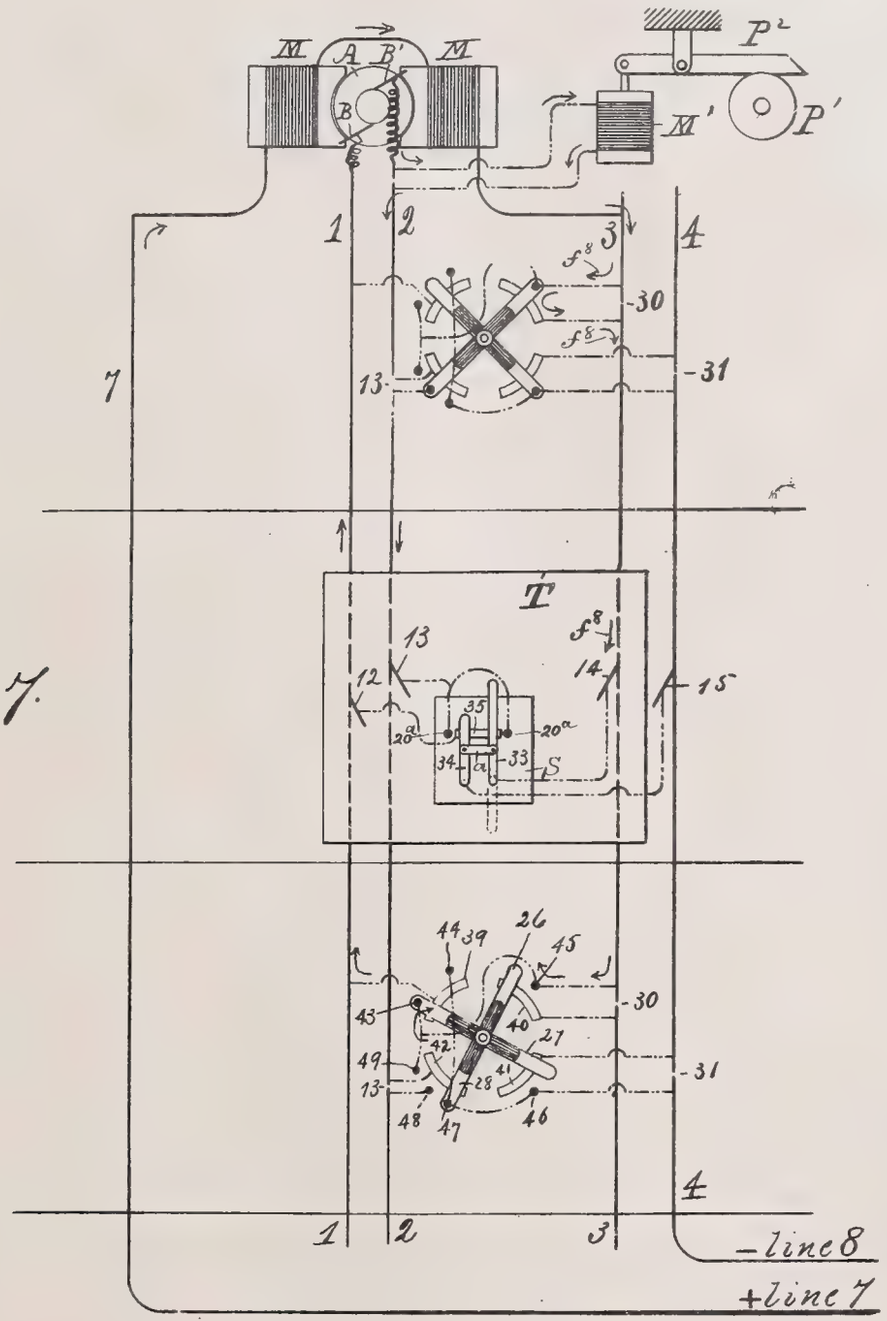
(No Model.) 14 Sheets—Sheet 5.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

Fig. 7.



Attest:
L. Lee.
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(No Model.) 14 Sheets—Sheet 6.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

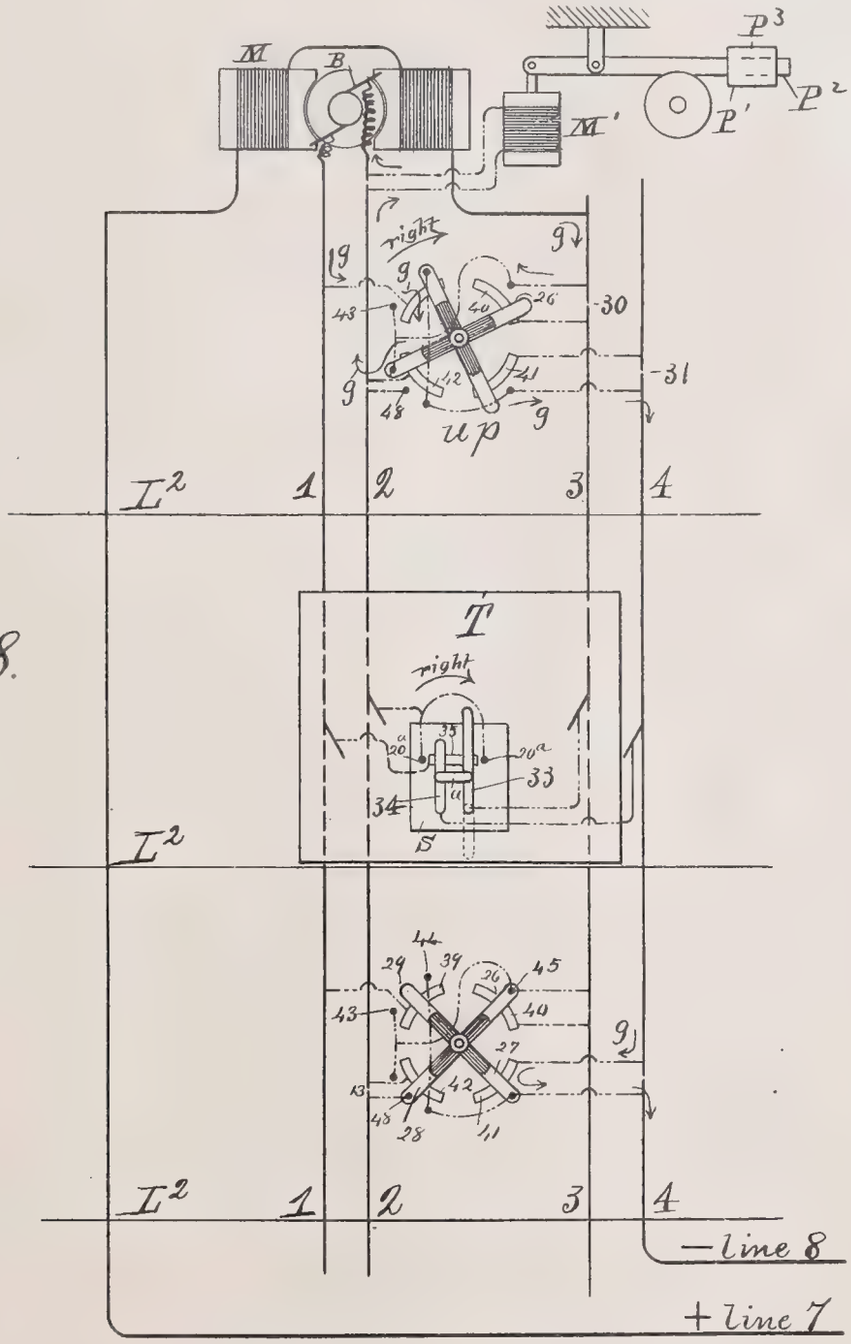


Fig. 8.

Attest:
L. Lee
F. C. Fischer.

Inventor.
William Baxter, Jr.,
per Crane & Miller, Attys.

THE NORRIS PETERS CO., WASHINGTON, D. C

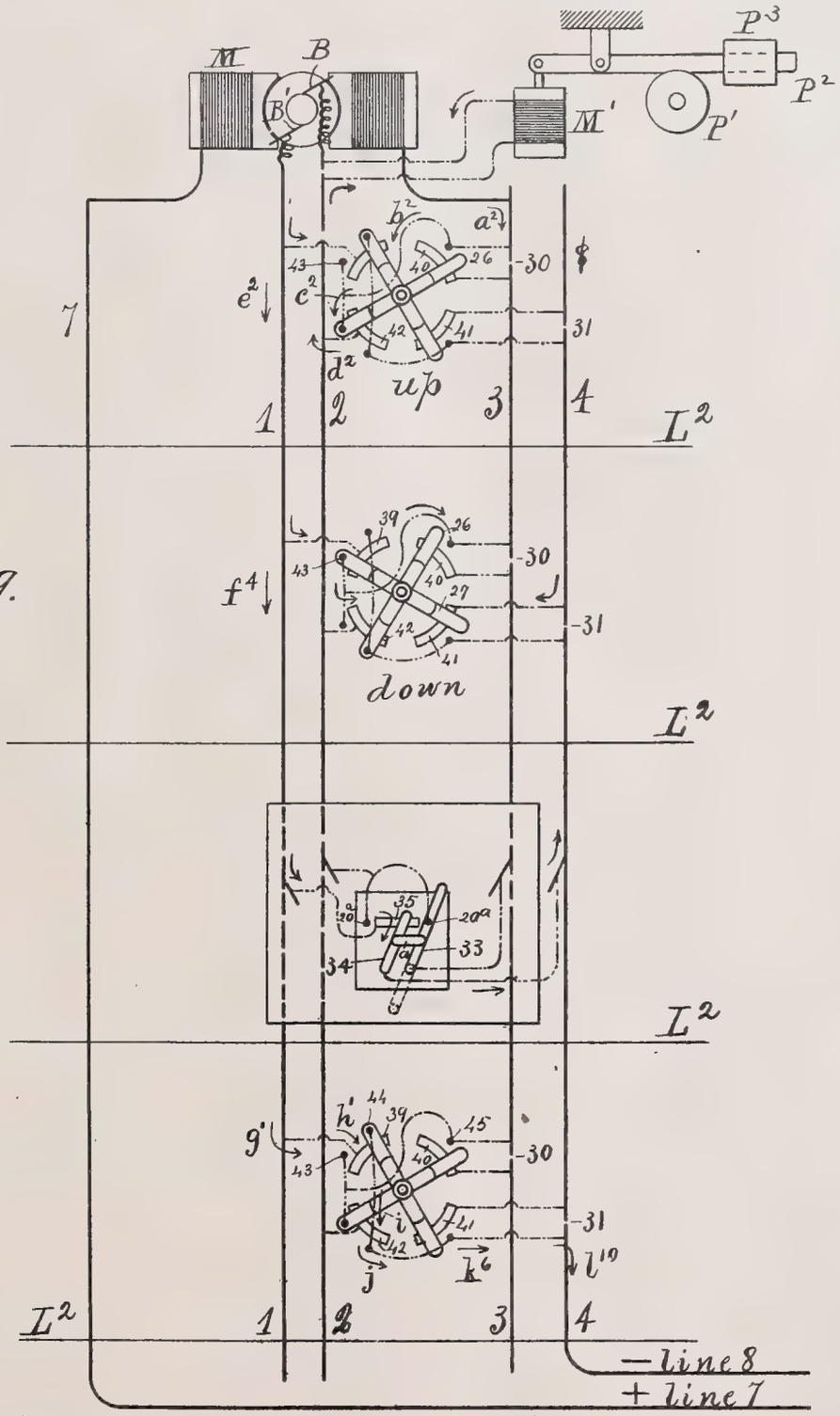
(No Model.) 14 Sheets—Sheet 7.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

Fig. 9.



Attest.
E. Lege.
F. C. Fischer

Inventor.
William Baxter, Jr.,
per Crane & Miller, Attys.

THE NORRIS PETERS CO., WASHINGTON, D. C.

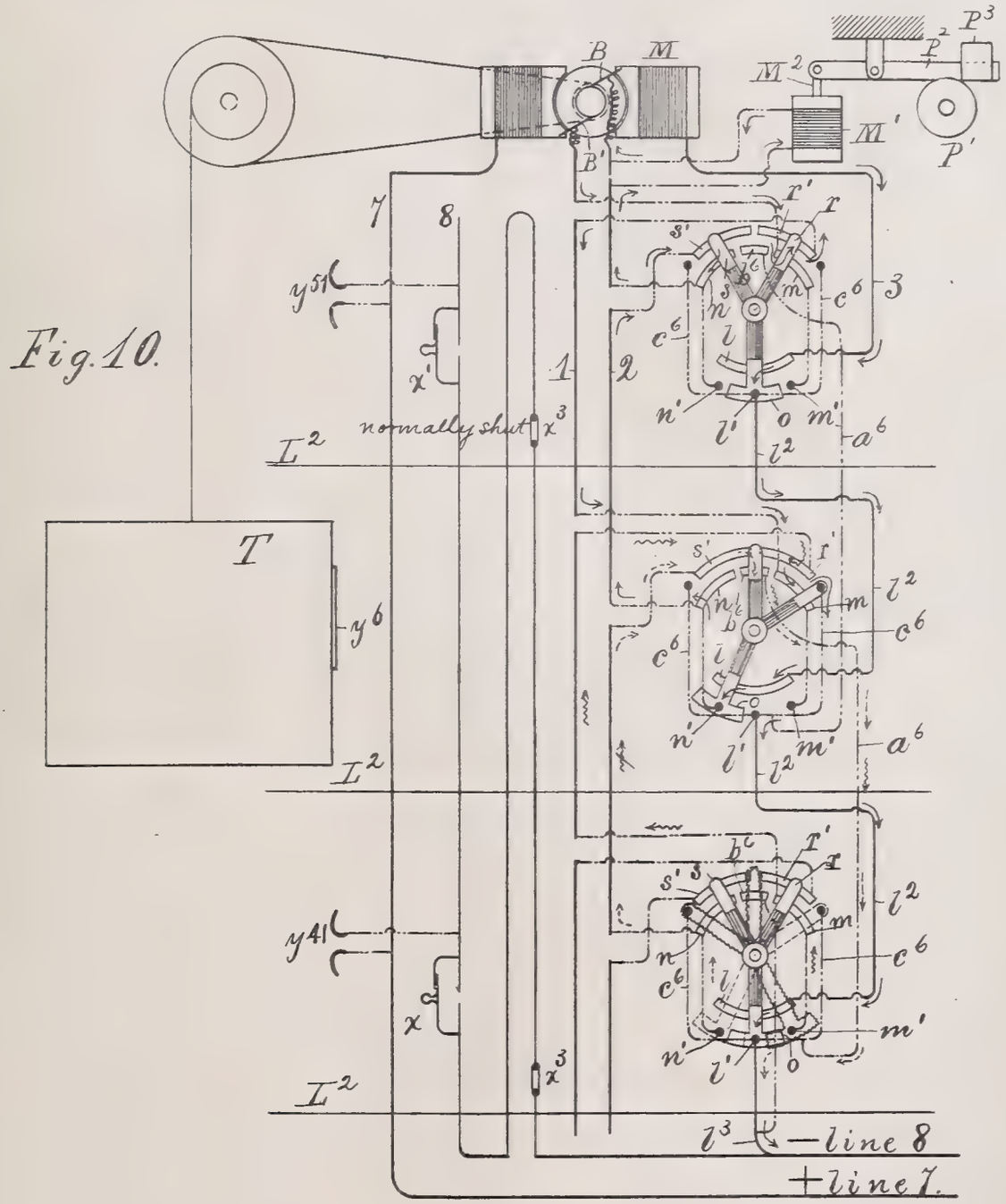
(No Model.) 14 Sheets—Sheet 8.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

Fig. 10.



Attest.
L. Lotz.
F. C. Fischer.

Inventor.
William Baxter, Jr.,
per Crane & Miller, Attys.

THE NORRIS PETERS CO., WASHINGTON, D. C.

(No Model.) 14 Sheets—Sheet 9.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

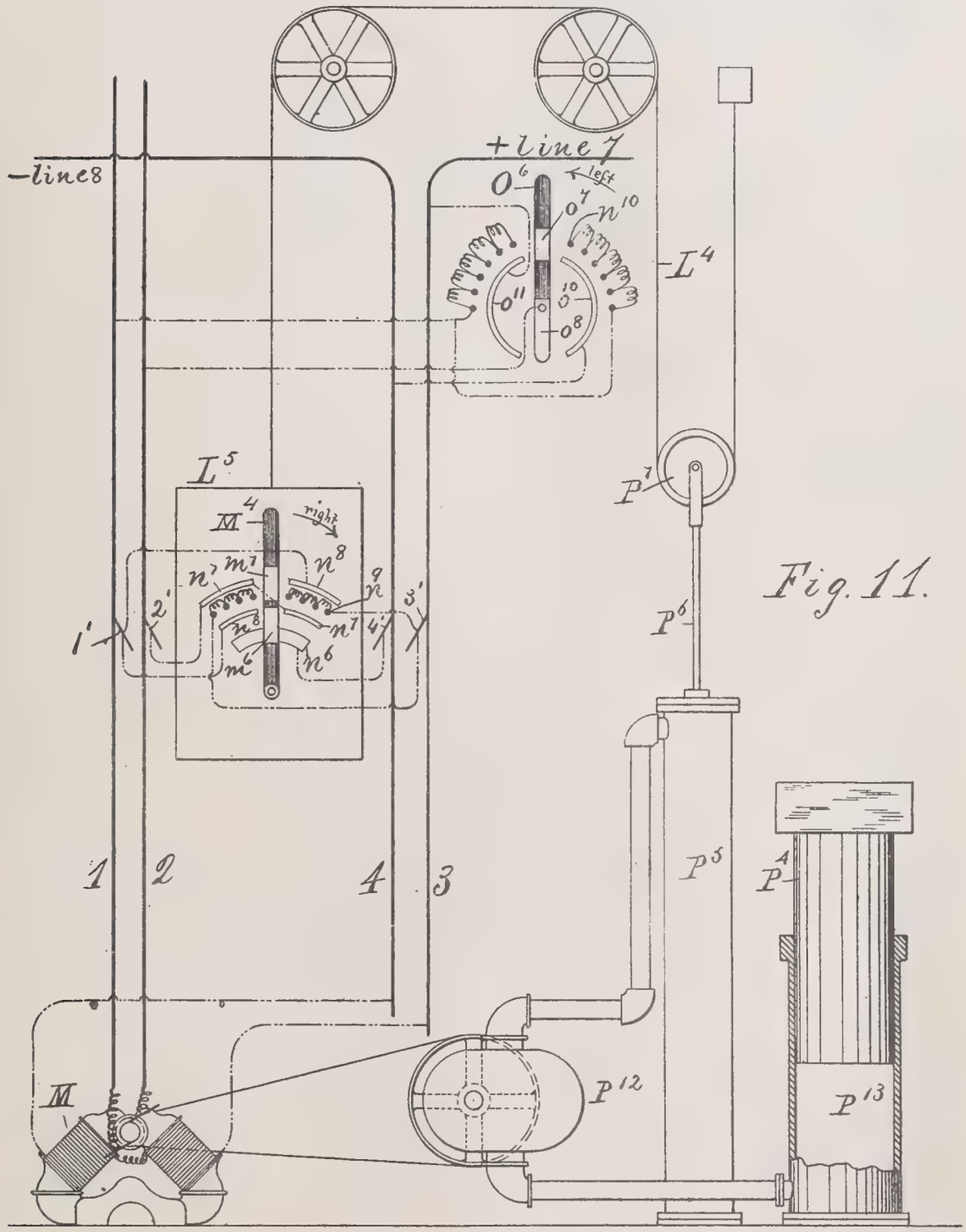


Fig. 11.

Attest.
L. Lee.
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William Baxter, Jr.,
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(No Model.) 14 Sheets—Sheet 10.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

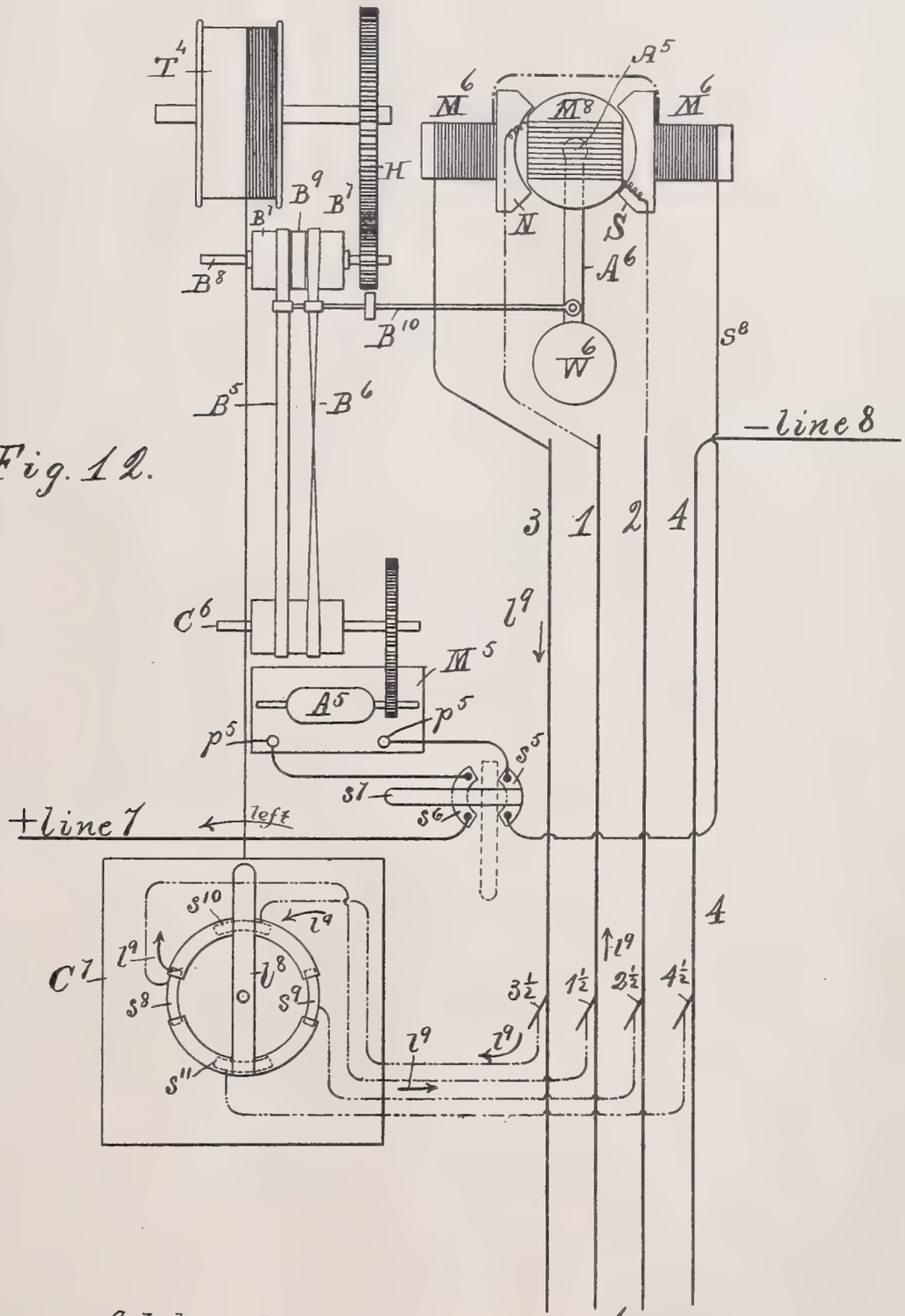

Fig. 12.

Attest.
L. Lee.
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Inventor.
William Baxter, Jr.,
per Crane & Miller, Attys.

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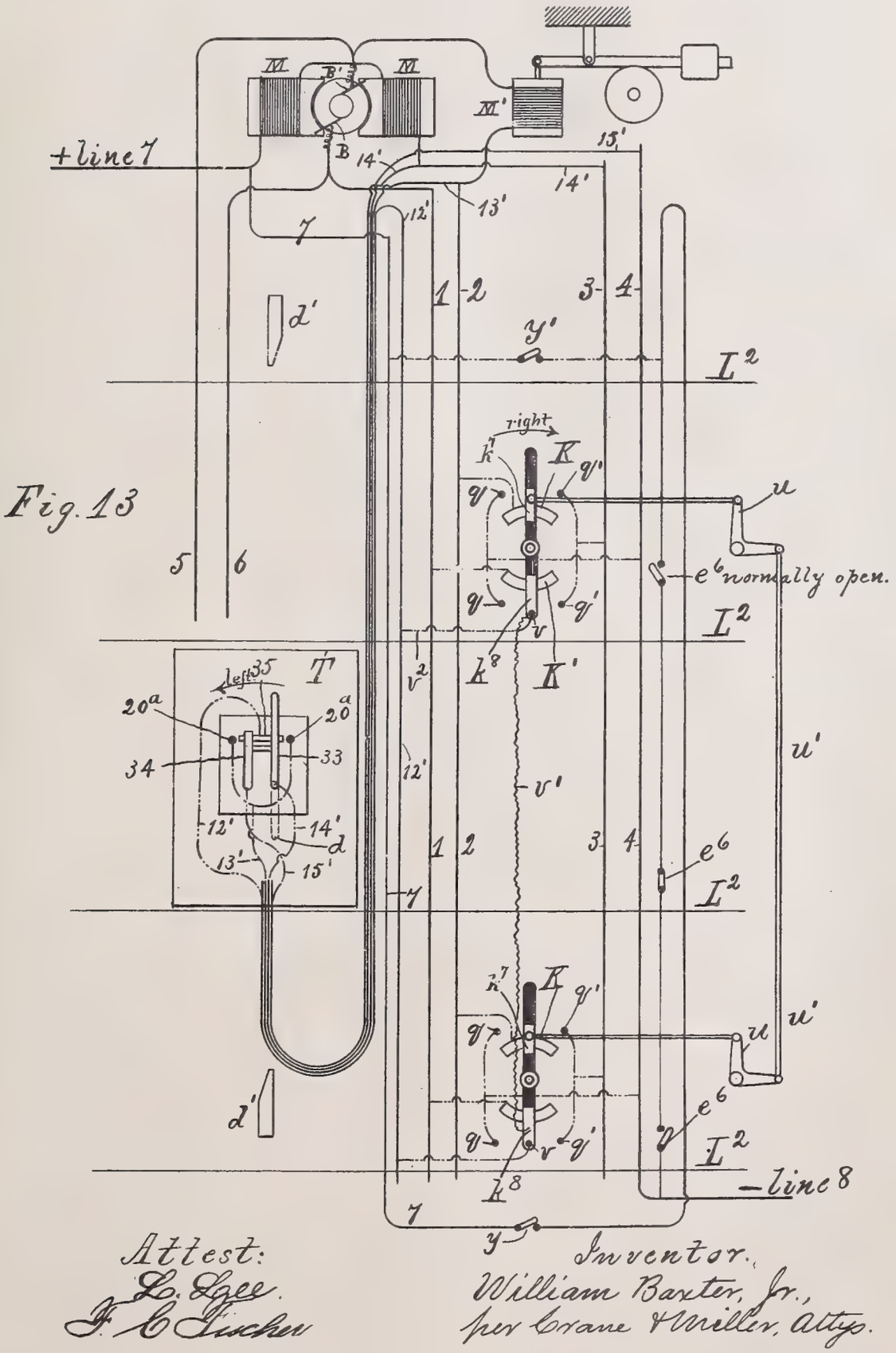
(No Model.) 14 Sheets—Sheet 11.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

Fig. 13



Attest:
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F. C. Fischer

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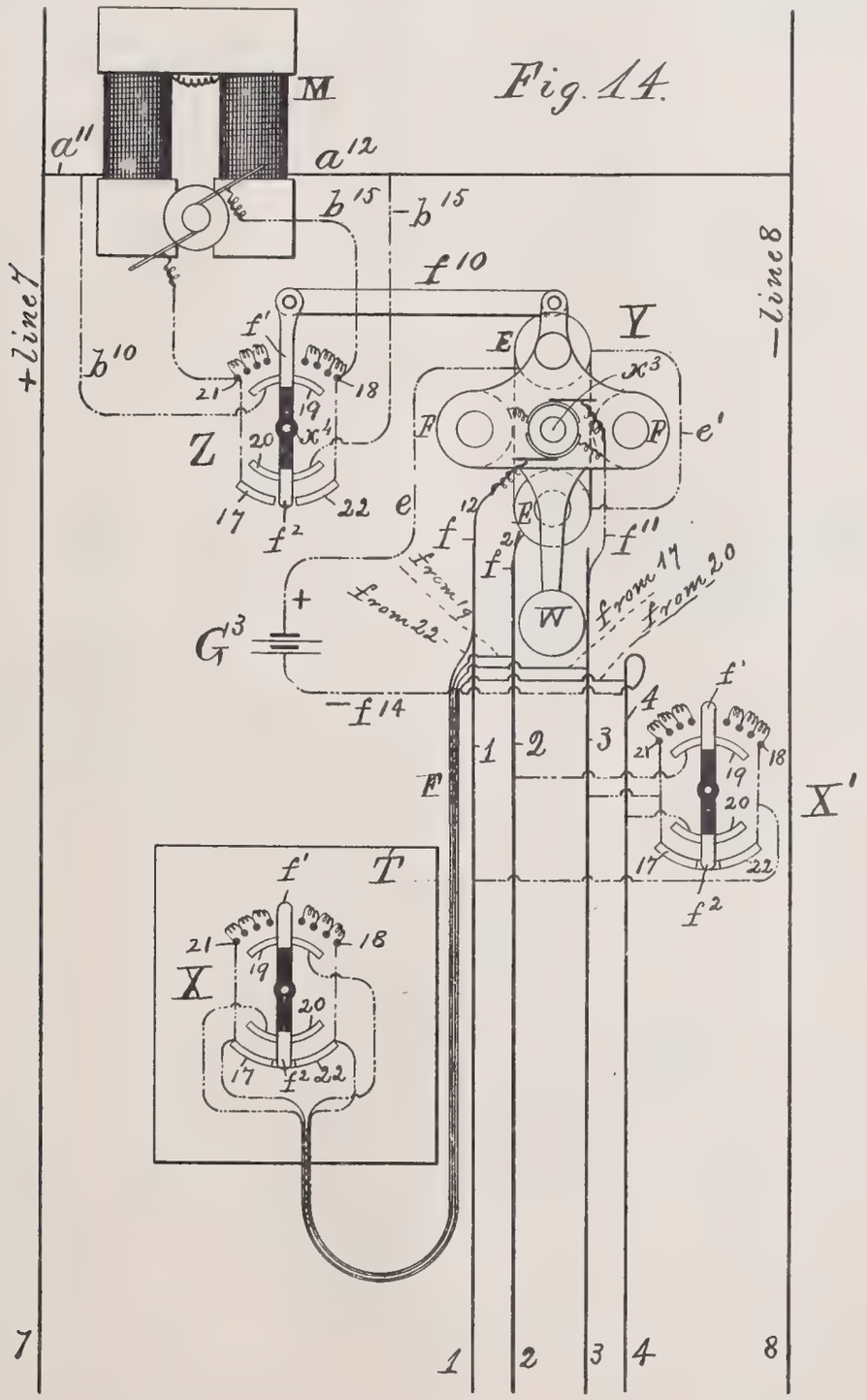
(No Model.) 14 Sheets—Sheet 12.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

Fig. 14.



Attest.
L. Lee.
F. C. Fischer.

Inventor.
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(No Model.) 14 Sheets—Sheet 13.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

Fig. 15.

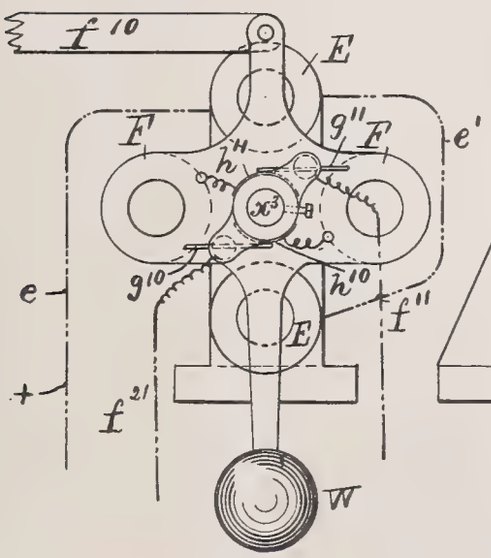
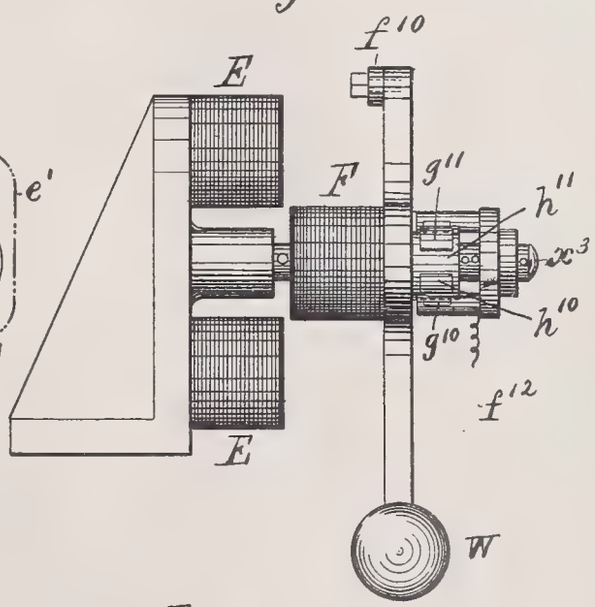


Fig. 16.



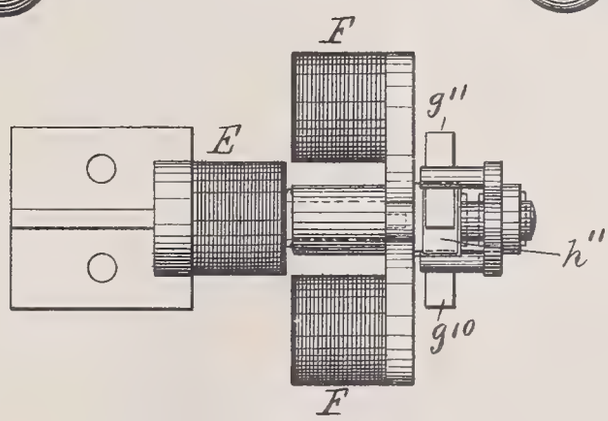


Fig. 17.

Attest.
L. Lee.
F. C. Fischer.

Inventor.
William Baxter, Jr.,
per Crane & Miller, attys.

THE NORRIS PETERS CO., WASHINGTON, D. C.

(No Model.) 14 Sheets—Sheet 14.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

No. 449,611. Patented Mar. 31, 1891.

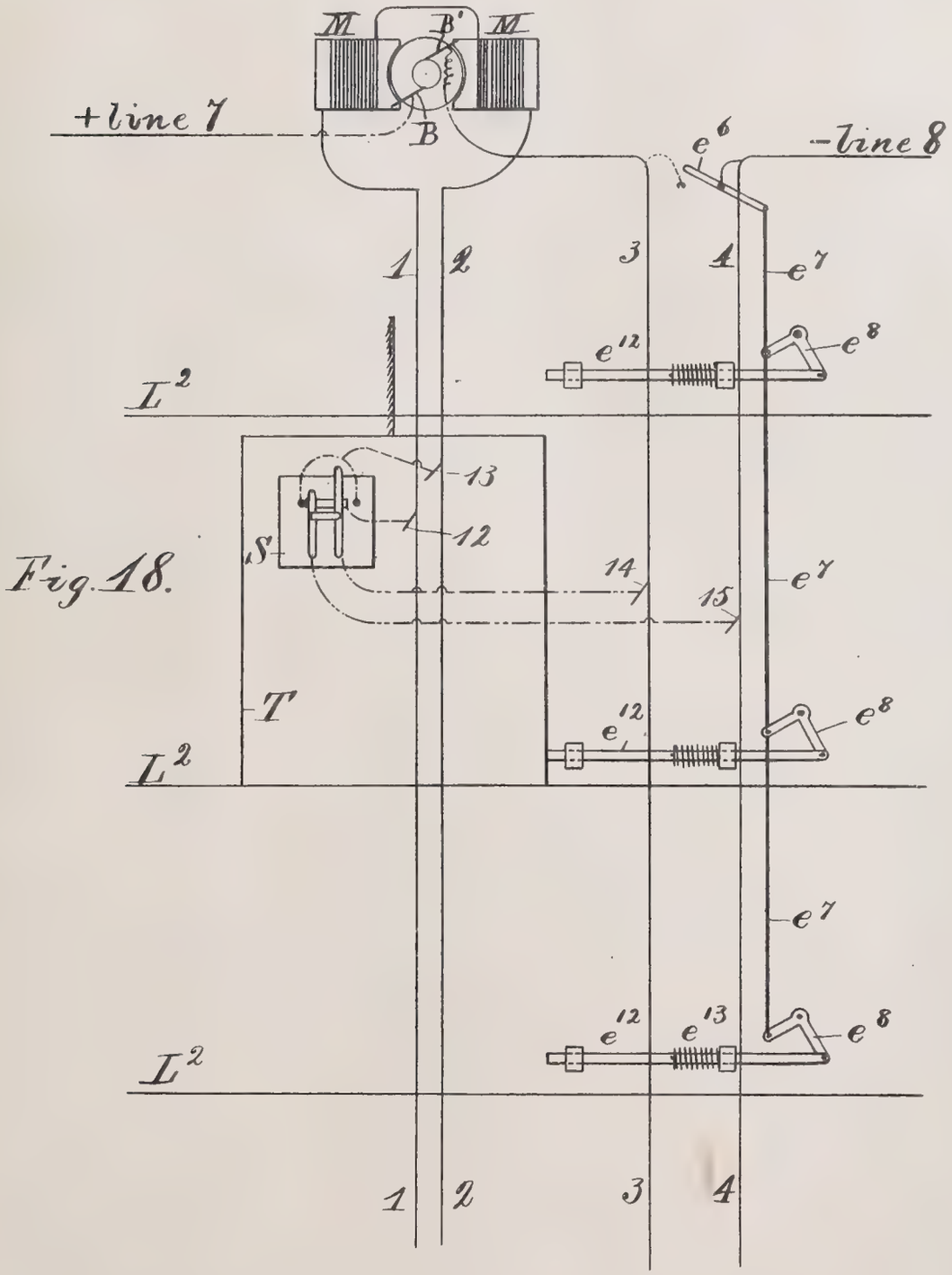


Fig. 18.

Attest:
L. Loye.
F. C. Fischer.

Inventor.
William Baxter, Jr.,
per Crane & Miller, atty.

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM BAXTER, JR., OF BALTIMORE COUNTY, MARYLAND.

SYSTEM OF OPERATING ELECTRIC ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 449,611, dated March 31, 1891.

Application filed March 17, 1888. Serial No. 267,524. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM BAXTER, Jr., a citizen of the United States, residing in the ninth election district of the county of Baltimore, State of Maryland, have invented certain new and useful Improvements in Systems of Operating Electric Elevators, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to a system for actuating elevator-hoisting mechanism by the energy of an electric current, and is adapted without modifications, except in immaterial mechanical details, to move the car or platform in either a vertical or an inclined path. The devices described herein are intended for use with a stationary hoisting device having a rotating drum or pulley to actuate a rope for raising the car or platform by which the load is carried, and the construction or mode of operation of the hoisting device is entirely immaterial. The car may be counterbalanced or not, and the hoisting-rope may be wound upon the drum or simply turned about a pulley and actuated by a frictional contact therewith, as the object of my appliances is to stop and start or reverse the movements of the hoisting mechanism, whatever its nature, by the current in a main electric circuit and branch circuits derived therefrom and controlled by suitable switches located therein and fixed upon the car or the hoistway-landings.

The invention involves the use of an operative electric circuit the current in which is controlled by switches located either upon the car or at stations along the path of the car and operated to affect the hoisting mechanism in the desired manner to raise or lower the car or to stop the same at pleasure.

Heretofore motors have been used to operate hoisting mechanism, and if connected therewith the armature would be turned in a reverse direction by the descent of the weighted platform, with a view of converting the motor into a generator and to store up the current thus produced for future use. I do not claim such mode of operation; but in one modification of my invention I construct the circuits and switches so that the motions of the motor may be reversed at the pleasure of the operator for the purpose of actuating the hoisting apparatus in reverse directions to raise or lower the car, as desired. Such construction is more simple than when the motor is alternately employed as a generator, and is more suitable for use in a circuit derived from a central station for the distribution of light or power in which other electrical apparatus would also be connected. In such a circuit the current employed is unavoidably furnished with a current of constant potential or constant strength, and in such case the motor-circuit and the contacts in the switches require to be arranged in a suitable manner to avoid in the one case making a short circuit and in the other case making an open circuit. Such arrangements are fully shown herein; but it is obvious that others may be used without departing from my invention.

The means for carrying out my invention consist, partly, in such an arrangement of the circuit-wires and switches that the action of the hoisting mechanism may be controlled from the car when it is in motion or standing still; partly in such an arrangement of the circuit-wires and switches that the hoisting mechanism may be controlled from any desired station along the path of the car; partly in such an arrangement of the circuit-wires and switches that the opening of a door or gate opposite a car-landing will operate a switch to stop the action of the hoisting mechanism, and thereby prevent the car from leaving such landing until the door is closed; partly in an arrangement of circuits with a switch and indicator at the car-landing to show when the switch is turned whether the car is in motion; partly in an arrangement of circuits with a switch at the car-landing to be moved by the opening of the door, and adapted when thus moved to stop the car when it reaches such landing, and in a modification of the same in which the closing of the door would actuate the switch to automatically start the car upon its course; partly in magnetic locking devices and switches whereby the various landing-doors would be held closed until the car reached the landing at such door; partly in an arrangement of switches to stop the car at the opposite ends of its course or travel, and partly in the specific construction of the switches and their electrical connections, and

in other details of construction. When the switch is located upon the car, the electric current may be conveyed thereto by means of sliding or rolling contact-pieces bearing upon stationary conductors placed along the path of the car, or by flexible cables containing suitable electric conductors. The operation of the electrical circuits is somewhat different when a constant current or constant potential is used in the circuits; but I have shown both constructions herein and claim the same generically, while I have claimed the particular arrangements for operating with a constant potential and fixed conductors, as well as the arrangements for using the constant current and the constant potential with a flexible conductor to the car in other applications, Serial No. 271,328, filed April 20, 1888, Serial No. 280,394, filed July 19, 1888, and Serial No. 284,397, filed September 3, 1888.

I have herein shown a variety of modifications to illustrate the scope of my invention.

In the annexed drawings, Figure 1 represents an electric hoisting-machine with a diagram of the electrical connections required, with stationary conductors fixed along the hoistway and switches for operating with constant currents. Fig. 2 is a diagram of the car-switch upon a larger scale; and Fig. 3 is an edge view of the back of the car, upon a larger scale, in section, one pivot of the car-switch, the hand-lever and its attached crank end being shown in section, and two switches being shown in the same figure in a line with the pin upon said crank. Fig. 4 represents a diagram of an electric motor and the connections required with stationary conductors along the hoistway, and switches for operating the same with constant potential. Fig. 5 is a diagram of the motor with car and landing switches and connections for a constant-potential circuit, the lower landing-switch being turned to move the car in one direction, and the car-switch moved to actuate it in the opposite direction. Fig. 6 is a diagram of the motor with car and landing switches and connections for a constant-current circuit, the car being shown in two different positions in the hoistway. Fig. 7 is a similar diagram with the car between the two landings and its switch in the normal position with the lower landing-switch turned to bring the car down to such landing. Fig. 8 is a similar diagram with the upper landing-switch turned instead of the lower one. Fig. 9 is a similar diagram with three landing-switches and a car-switch, all turned from their normal positions. Fig. 10 is a diagram showing a motor and constant-current circuit having only landing-switches connected therewith. Fig. 11 represents an electric motor connected by belt with a reversible rotary pump and a hydraulic lifting apparatus, and electrical circuits for stationary conductors arranged along the hoistway, and switches for operating such circuits with constant potential. Fig. 12 is a diagram of an electric motor operating a counter-shaft and the latter connected with a hoisting-drum by straight and crossed driving-belts, a belt-shifter being applied to such belts and connected with a magnetic armature, and electric circuits and switches being shown for controlling the movement of such armature to shift the belts. Fig. 13 is a diagram of a stationary electric motor with circuits and switches adapted for conveying the electric current to and from the car through a flexible conductor or cable, the circuits and switches being constructed to operate with constant current. In all the figures above described the switches are shown operating directly upon the main motor-circuit or circuits derived therefrom; but in Fig. 14 is shown a construction for using an independent electrical generator and circuits connected with the moving car (and a switch thereon) by a flexible cable, the variations in the current produced by the switches upon the car or car-landing serving to actuate a magnetically-moved switch in the main motor-circuit, and thereby controlling the movements of the hoisting-motor in the desired manner. Fig. 15 is an enlarged view of the magnetic shifter; Fig. 16 an edge view of the same; Fig. 17, a plan of the same; Fig. 18, a diagram of the door-switches.

The current through the independent generator and circuits in such case is varied by the car-switch or landing-switch in the same manner as if it were the primary circuit through the electric motor; and my system of electrical connections and switches is therefore used in the same manner and to the same degree as when no independent circuit is used, and such independent generator and circuits may be used with fixed conductors along the hoistway (instead of cable conductors) and may be operated with either a constant current or constant potential in the circuits.

In the various diagrams in the drawings an elevator-car is shown suspended by a hoisting-rope, and the car in such case would commonly be operated in a well or hoistway provided with landings at the top and bottom and at intermediate points; but my system of electrical connections is adapted for an inclined hoistway, such as is used in mines, or for any other arrangement in which a movable car or platform is lifted by a rope, band, or chain connected with a stationary hoisting-machine.

Where a closed hoistway or well is used, doors are commonly employed to give access to the car when at the landings, and my invention provides means for locking such doors with electrical connections adapted to effect the following objects: first, to unlock the doors when the car is at the landing; secondly, to stop the car when it arrives at the landing; thirdly, to prevent the car from being moved so long as the door is open, and,

fourthly, to start the car automatically as soon as the door is closed in the same direction that it was moving before its stoppage.

In private dwellings, where an attendant is not employed to operate the elevator, the car would be actuated chiefly by means of the landing-switches, and I provide an indicator or bell to be actuated by a branch circuit to show before the landing-switch is operated whether the car is already in motion.

In constructing such a system of electrical circuits and switches as is contemplated in my invention I arrange the circuits and switches with reference to the constant current or constant potential (that may be supplied from the electric generator) by observing two distinctions: first, that when the system is operated with a constant current the various landing-switches are connected in series; but when a constant potential is used said switches are connected in multiple arc, and, secondly, when the constant current is used the stoppage of the electrical hoisting apparatus is effected by short-circuiting, whereas when the constant potential is used the stoppage is effected by opening the circuit. Such variations in the construction and operation of the switches are required to maintain a passage for the current in one case, while in the other the electric generator in producing a constant-potential current is adapted to compensate automatically for the opening of the circuit at any point.

Describing my invention in connection with Fig. 1, an electric motor is shown connected by a belt P^6 with a hoisting-pulley P^7, and 7 and 8 are the positive and negative line-wires or connections to the generator. M are the coils of the motor-magnet; A, its armature; A′ its armature-shaft, employed to actuate the hoisting-mechanism, and A^2 the commutator. The lines 1 2 3 4 represent conductors which would be fixed rigidly along the sides of the hoistway parallel with the movement of the car, and 12, 13, 14, and 15 are contact-pieces adapted to move along such conductors to convey the current to a switch S upon the car T. The conductors 1 2 are shown connected with the commutator-brushes B B′, and the conductor 3 is connected with one extremity of the field-coils. The negative line-wire 8 is shown connected with the conductor 4 at the end near the motor, and the positive line-wire 7 with the other extremity of the field-coils, the motor being shown wound in series, and the car-switch adapted to receive the current from such coils through the conductor 3, and to divert it at pleasure into either of the conductors 1 or 2, so as to reverse the motion of the armature and to lead it thence to the line-wire 8 by conductor 4. The car-switch and the electrical connections in the diagram are adapted for constant current. The car-switch requires two contacts receiving the current, respectively, from the field-coils and from one of the brushes, and two contacts for delivering it, respectively, to the other brush and to the negative line-wire.

The car-switch is shown upon a larger scale in Fig. 2, formed of two conducting-levers 33 and 34, arranged to bear when in their neutral or normal position upon a contact-strip 35, which operates to connect them electrically, and to thus form a short circuit between the conductors 3 and 4, to which such levers are connected by wires to the contacts 14 and 15. The strip 35 is connected to the contact 12 on conductor 1, and the levers are tied together by a non-conducting link *a*, so that both may be moved at once; and two contact-studs 20^a are arranged near the ends of the strip 35 and connected together and with the brush 13 upon the conductor 2. Such switch is adapted particularly to operate with constant current, with which it is necessary at all times to avoid an open circuit, and the levers are therefore made wide enough to touch both the strip and the stud when moved toward the latter. Supposing the switch-levers to be pushed toward the left to make the car go down, the course of the current through the various conductors would be, as indicated by the arrows *b*, from conductor 3 to contact 14, lever 33 and contact 12 to brush B, and from brush B′ to contact 13, lever 34, and contact 15 to the conductor 4 and line-wire 8. The current would thus pass through the armature in a given direction, as to make the car go down; and to cause its ascent the switch-lever would be pushed to the right, and the current would be reversed through the armature, as indicated by the arrows *c*.

Fig. 3 shows the pivot of the lever 33 extended through the side of the car and provided with an arm having a projecting pin *d*. Blocks *d′* with inclined faces are shown in Figs. 1 and 3, fixed in the path of the pin at the extreme opposite ends of the car's travel and adapted to shift the pin (and with it both the switch-levers) to the central position shown in Fig. 1. When thus shifted, the motor-armature would be short-circuited by the connection of the conductors 3 and 4, and the car would therefore stop, and the relation of the incline to the pin *d* would necessarily be such that when the car was thus stopped at either end of the route the switch could be shifted still farther to cause its movement away from such incline to travel over its path toward the other incline. A solenoid magnet-coil M′ is shown connected with the armature-circuit by a loop between the conductor 2 and the brush B′, and the core M^2 of the magnet is represented as connected with a brake-lever P^2. The lever is provided with a weight P^3 to press it normally upon a brake-wheel P′, which would be connected with the hoisting-pulley, and the magnet would operate, when energized by the current, to move the lever in opposition to the weight, and thus relieve the brake-wheel of the friction imposed by the lever.

With this construction the closing of the circuit through the armature, which is required to actuate the hoisting mechanism, operates positively to remove the friction of the brake, while the cutting off of the current from the armature-circuit automatically releases the brake-lever and permits it to press upon the brake-wheel P'. The hoisting-pulley is thus held securely when the motor is stopped independently of the motor-gearing, while it is automatically released from the pressure of the brake whenever the motor is started. Lines L^3 are drawn across the hoistway at intervals to represent the location of landings, and *e* represent switches held normally open in branch circuits connecting the conductors 3 and 4 and adapted to be closed by a suitable connection to the landing-door when the latter is opened. The switch opposite the car is shown closed; but the doors are not shown in the diagram, as they would only obscure the electrical connections; but it is obvious that a door-switch may be operated by the door to short-circuit the motor when operating with constant current, and to thus prevent the car from being started until the landing-door is closed. Each door may also be provided with a locking device to secure the door normally shut, and provided with a solenoid L, which would be actuated by the automatic shifting of a switch *s*, when the car is moved to the landing in suitable position for the door to be opened. Such solenoid is shown in the diagram connected with a loop of the conductor 4 formed around a gap or break *s'*, and it would be necessary to keep the circuit through the solenoid-coils closed during the movement of the car to maintain a continuous current through the conductor. The switch *s* is arranged to normally close the circuit around the solenoid and the door lock or bolt is actuated by a spring *t* to normally lock the door, the car operating when it reaches the landing to open such switch and permit the current to pass through the solenoid-coils. The solenoid then operates in opposition to the spring to withdraw the bolt or locking device to permit the opening of the door. Between the lowest two landings a dotted outline D^3 is inserted to represent a door and the door-lock is represented as a bolt D^4, operating through the door-frame D^{12} and formed with a sloping point and passed through a solenoid and adapted to engage a notch D^5 in the top of the door. The wires s^2, between which the switch *s* is located, form a loop of the conductor 4 through the solenoid-coils and the switch is held normally open, as shown in the figure, until moved by a suitable connection to the car when it reaches the landing, as by rod *t'*. The door-locks are shown at two of the landings and are omitted from the others to avoid obscuring other parts. It is immaterial how the door-locks and door-switches for short-circuiting the motor are constructed, as their electrical connections and relations to the other electrical elements of the system do not form the subject of my present invention.

In Fig. 4 is shown a means of governing the hoisting mechanism by switches applied to the landings as well as to the moving car, the diagram showing connections adapted for use with constant potential, and the car-switch being connected with the operative circuit by contacts moving upon conductors fixed in the hoistway, as in Fig. 1. The motor, the conductors, the line-wires, the brake-magnet, the car, and the landings, are lettered the same as in Fig. 1; but the switches, being designed normally to open the circuit, are constructed differently. Each landing-switch is constructed with six contacts, two of which 19 and 20 are of segmental form, fixed at opposite sides of a central stud *f*, and connected, respectively, with the conductors 4 and 3. Upon the stud is pivoted an arm having at its opposite ends metallic springs *f'* and f^2, bearing upon the segments and projecting beyond the same to reach the other four contacts. The arm is of non-conducting material, so that the springs serve merely to connect the contacts they touch. Adjacent to the segments upon one side of the arm when in its middle position are contacts 17 and 21, connected with the conductor 1, and upon the opposite side contacts 18 and 22, connected with the conductor 2. When the arm is in its middle position, as shown in the drawings, the springs touch only their respective segments and connect none of the contacts, and the outer contacts are so arranged that when the arm is turned to the right, as indicated by the arrow marked "right," the segment 20 may be connected with the contact 17, thus joining the conductors 4 and 1, the segment 19 being simultaneously connected with the contact 21 to connect the conductors 3 and 1, as per arrows *a'*. Supposing such movement of the current rotates the motor to cause the ascent of the car, then by turning the arm to the left the contacts 20 and 17 would connect the conductors 4 and 1 and the contacts 18 and 19 would connect the conductors 3 and 2 and cause the reversal of the motor to make the car descend. Adjacent to the contacts which are connected with the commutator-brush conductors are shown additional contacts *r'*, with intermediate resistances *r*, which form a connection with the segment 19 when the spring *f'* is first moved from its normal position. Such resistances operate to prevent the entire current from entering the armature when the switch-arm is first moved, and thus avoid starting the motor too violently, while the gradual movement of the spring *f'* past the resistances gradually increases the current through the armature until the maximum is attained. The motor is represented as series wound like that in Fig. 1, the current passing from the conductor 3 in all cases to the conductor 2 or 1 to actuate the motor, and from thence to the conductor 4 and the line-wire 8. The movement of the switch in either direc-

tion, as just described, therefore connects the conductor 3 with one of the commutator-brushes, and simultaneously connects the other brush with the negative line-wire, thus causing the rotation of the armature in reverse directions, according to the movement of the switch, while the placing of the arm in its normal or middle position opens the circuit and causes the stoppage of the motor. As the constant-potential circuit is not adapted to work without a suitable resistance, each switch is constructed to avoid short-circuiting the motor and is arranged, as already shown, so that when in its normal or middle position it will open the circuit by connecting none of the contacts. A similar switch is shown upon the car, with the springs upon the switch-arm similarly lettered, and the several segments and contacts are indicated by the same numbers as in the landing-switch, with a "prime" mark added thereto. The moving contact 12 upon the conductor 1 is represented, as in the landing-switch, connected with the switch-contacts 17′ and 21′. The moving contact 13 upon the conductor 2 is connected with the contacts 18′ and 22′. The moving contact 14 upon conductor 3 is connected with the segment 19′, and the moving contact 15 upon conductor 4 is connected with the segment 19′. The car-switch therefore operates in all respects like the landing-switch, and when connecting the segment 20′ with the contact 22′ (by the turning of the arm to the right) it causes the car to ascend, as before described, as per arrows c'. The diagram does not attempt to show the true position of the conductors with reference to the car or to the landing-switches, as it would obviously obscure the drawing to show an actual hoistway with suitable conductors arranged therein for the moving contacts, and with landing-switches located at the sides of the hoistway and suitably connected with the conductors. The diagram shows the electric circuits; and the relation of the car-switch to the landing-switches, when the car is at different points in its travel, may be readily determined by tracing the path of the current through the conductors, as is fully shown in the other figures, in which the switches are shown in various positions. Where a series of switches operate by a constant potential, there is a liability to short-circuit the motor when two switches are turned at once in opposite directions. I have shown in the other figures an electric bell as a means for indicating to an operator at any landing whether the car is already in motion and its switch therefore turned from its normal position, and when such indicator is used it is only through malice or carelessness that the landing-switch would be turned to produce such short circuit. To avoid the damage which might result to the dynamo which supplies the current in such a constant-potential circuit, in case a short circuit were produced, fusible plugs f^3 are inserted in the switch connections, as are shown in the connection between the segment 20 and the conductor 4 in Fig. 4. It is obvious that if the landing-switch should be turned in the same direction as the car-switch it would connect the same conductors and produce no short circuit; but if a car-switch is turned in one direction to connect the conductors 3 and 1 while the landing-switch were turned in the opposite direction to connect 1 and 4 a short circuit would result and the fusible plugs would be required, and such plugs would then by their melting open the circuit immediately.

Fig. 5 shows the connections for a constant-potential circuit with a shunt-wound motor and car and landing switches arranged in the circuit, the lower landing-switch being turned to the right as to go up and the car-switch turned to the left as to go down, as shown by the arrows marked "right" and "left." With a shunt-wound motor the current passes partly through the magnet-coils and thence to the negative line-wire, and the open circuit, which is produced by the switches, is formed only in the armature-circuit. The conductor 3 is therefore interrupted at each landing and the switches provided with an additional contact connected with the segment 19 by the spring f', to normally close the circuit around the break 13 formed in such conductor. The series of landing-switches thus operate normally to maintain a circuit (through conductor 3) to the car-switch, but break the connection to the same when moved to actuate the motor. The breaks may be formed, as by a short overlapping of the adjacent parts of the conductor, so that the contacts 12, 13, 14, and 15 may move over them without obstruction, but lose the current from the previous section of the conductor when passed beyond the same. The first function of the landing-switch in actuating the motor is to shift the spring f' to open the circuit around the break 13, and, second, to close the circuit from the conductor 1 to the conductor 2 or 3, as may be required, the spring f^2 simultaneously connecting one of the brush-conductors to conductor 4 and the negative line-wire 8. In a system with a shunt-wound motor the final terminal of the magnet-coils is connected with the conductor 4 and the current from both passes through the coils of the brake-magnet M′ to the line-wire 8. The arrows d indicate the path of the current through the landing-switch to connect the conductors 3 and 1, while the arrows d'' show the passage of the current through the car-switch to connect the conductors 1 and 4. The current thus finds a course from 3 to 1 and 1 to 4 and produces a short circuit. The fusible plug f^3 is shown in the connection from the car-switch to the moving contact 14, instead of in the several connections from the conductor 1 to the contacts 20 in the landing-switches. When thus located it obviates the use of a number of separate plugs in the separate connections from the landing-switches to correct a short circuit through the car-switch.

The fuse may, however, be placed in any suitable location, as in the connections from conductor 3 to the segments 10 in Fig. 5. It will be noticed in reference to Fig. 5 that the motor will receive the current to move the car when both the car and landing switches are turned in the same direction; but when turned in opposite directions a short circuit will result and the car will not be moved, but the fuse will be melted. Although such fuse may be readily replaced, its melting is wholly unnecessary with the use of the indicator described herein, and it is only inserted in the connections as a safeguard against carelessness. The indicator is shown in connection with a system for constant current shown in Fig. 6. In this construction the similar parts are lettered the same as in Figs. 1 and 4, with the conductors 1 2 3 4 similarly arranged, and a branch circuit around the armature being formed by wires 5 and 6, connected, respectively, with the conductors 1 and 2. At each landing an electric bell k^3 is shown actuated by an electro-magnet k^3, which is placed in circuit with the wires 5 and 6 by the closing of a switch k^4. The switch is held normally open, and is closed when the operator desires to learn if the car is in motion, the magnetic bell being then actuated by the difference of potential in the conductors 1 and 2. When the motor is not in operation, the counter electro-motive force of the armature is nothing; but when the motor is in operation the counter electro-motive force is developed to a sufficient degree to establish a branch circuit from the conductors 1 and 2 through the wires 5 and 6 and to actuate the bell in the desired manner. By pressing an ordinary switch-button an operator at the landing may thus easily ascertain whether the motor or car is in motion. It is obvious that an annunciator of any kind, or other indicator giving notice to the eye instead of the ear, may be substituted for the bell. The motor is shown series wound with the line-wire 7 connected with one terminal of the field and circuits interposed between the other terminal of the field and the armature and between the armature and the other terminal of the line. The car and landing switches are provided with contacts to close these circuits through the armature in reverse directions; but provision is required in a constant-current circuit to keep the circuit always closed. The several switches are arranged in series and provided with contacts in such proximity as to maintain the circuit while the switch is moved from one contact to another. Breaks 30 are shown in the conductor 3 and breaks 31 in the conductor 4, and the landing-switches are provided with contacts normally connected to maintain the circuit around such breaks, the current being thus conducted from one switch to another along the broken conductor so long as the landing-switches remain unmoved. In Fig. 6 the car T is shown in two locations in the hoistway to illustrate the operation of the circuits when in such positions, and with landing-switches U, shown at the landings not occupied in the diagram by the car. In practice all the landings could be furnished with switches to operate the same as those shown. The car-switch is shown the same as in Fig. 1, with the moving contacts likewise arranged; but the landing-switches U are shown with two arms at right angles to one another, carrying four independent springs which operate upon four segments to connect them with adjacent contacts. As no resistances are required, the movement of the switch is quite small, and the contacts are placed in such relation to one another that the springs may form a new connection without making an open circuit. The car-switch operates normally to short-circuit the motor by conveying the current from conductor 3 to 4, as in Fig. 1, and the function of the landing-switch in actuating the motor is first to break this short circuit and next to complete a circuit through the armature. In all the diagrams the motor is shown at the top of the hoistway to make its relations to the switches more clear; but it is obvious that it may be located in any position and at any distance from the hoistway, as may be required to operate the hoisting mechanism. However it is located, the conductors 1, 2, 3, and 4 would preferably be connected at one end only to the line-wires or motor, and the switch nearest to such connected ends would, obviously, if there were a break in one of the conductors, receive the current in advance of any other switch. The conductors are shown thus connected at their top ends, and the top switch in each diagram would therefore receive the current from the broken conductor and would operate either to transmit it to those beyond or to divert it into the motor to actuate the same. The movement of the car past any such break would thus wholly deprive it of the current, except when a circuit were closed around the break by the landing-switch. The landing-switches shown in Figs. 5 and 6 operate thus to normally close the circuit around the break and to thus convey the current past the break to the car-switch, whatever its position in the hoistway. Any landing-switch, however, between the car and the tops of the conductors (the ends connected with the circuit) would operate to cut off the current from the car-switch when moved from its normal position, while those beyond the car-switch would have no effect upon such switch. In the landing-switches the four segments are numbered 39, 40, 41, and 42. The springs resting thereon are numbered 26, 27, 28, and 29, and contact-stud 45 is connected normally with the spring 26 and permanently with the conductor 3, the segment 40 being permanently connected with the same conductor upon the opposite side of a break 30. The contact-stud 46 is connected normally with the spring 27, and permanently with the conductor 4, the segment 41 being

permanently connected with the same conductor upon the opposite side of a break 31. The segment 42 is permanently connected with the conductor 2. The segment 39 is connected normally with the spring 29 and permanently with the conductor 1. By the side of the segment 42, connected with conductor 2, are studs 47 and 49, connected, respectively, with the conductors 4 and 3, and by the side of the segment 39, connected with conductor 1, are the studs 43 and 44, connected, respectively, with the conductors 3 and 4.

Fig. 6 shows the switches all in their normal position, the current passing from the conductor 3 into the spring 26 and back through the segment 40 to the same conductor beyond the break 30, and then traversing the said conductor to the moving contact 14, from which it passes through the car-switch to the moving contact 15, and through the conductor 4 to the line-wire 8. The car-switch thus operates normally to short-circuit the motor so long as the landing-switches are unmoved, whatever its position, as may be seen by tracing the arrows *e* in Fig. 6, to the car-switch in both of the cars represented in such figure.

Fig. 7 shows a similar diagram with the car in the middle of the hoistway, its switch in its normal position, and the lowest landing-switch turned to bring the car down to such landing. Such movement turns the spring 27 away from the contact 46 and thus opens the short circuit around the break in the conductor 4, the spring 26 at the same time being shifted from the contact 45 to open the short circuit around the break in the conductor 3. The spring 29 at the same time connects stud 43 (which is united to conductor 3) with the segment 39 and conductor 1 to lead the current from conductor 3 to the armature, the shifting of the spring 28 at the same time connecting the stud 47 (which is united to conductor 4) with the segment 42 to receive the current from the armature through the conductor 2 and lead it to conductor 4. The current after passing, as shown by the arrows f^8, around the break 30 in the conductor 3 through the two upper landing-switches is unable to find a short circuit through the car-switch, as the connection from the car-switch to the negative line-wire 8 is cut off by the movement of the spring 27 in the lowest landing-switch. No current, therefore, passes through the car-switch, and the motion of the motor is wholly controlled by the movement of the lower landing-switch. By turning the lower landing-switch the car may thus, whatever its situation in the hoistway, be brought down to the lower landing for the use of any one at that point.

Fig. 8 shows a similar diagram with the car-switch in its normal position and the upper landing-switch turned to bring the car up. The movement of this switch operates to wholly cut off the current from the conductors beyond the same, the short circuit through the car-switch being broken by the movement of the springs 26 and 27, and the current passing, as shown by the arrows *g*, through the spring 28 to one of the armature-brushes, and from the other to the spring 29, and to the conductor 4 and line-wire 8. From the above illustrations it will be seen that any person upon a landing above the car may operate the landing-switch so as to bring the car up, or by a landing-switch below the car may cause it to move down; and it will be also noticed, by tracing the path of the current in the various positions of the switches, that the landing-switch not only connects the various contacts therein to send the current through the motor-armature in the right direction, but it also opens the circuit through the car-switch by destroying the continuity in the loop around the break in the attached conductor. Such an effect upon the car-switch can only be produced with constant current, in which case the car-switch may be permitted to short-circuit the motor; but in a system using constant potential, as shown in Fig. 4, it would not be permissible to short-circuit the motor through any of the switches, and the car-switch is therefore held normally open, the same as the landing-switches shown in that figure. In cases where an operator is not employed to constantly attend the elevator-car, it is obvious that persons on different landings may desire to use the car at the same time, or may attempt to control the current by the use of the landing-switch when the car is in motion and its switch shifted. One of the objects of this invention is to furnish an electric-elevator system adapted to reconcile, as far as possible, the requirements for such a situation, and to avoid short-circuiting with constant potential or an open circuit with constant current. It is also especially adapted to prevent any injury to the several parts of the system from the contrary working of the switches, by accident or by different persons operating at the landing and in the car at the same time. A circuit operated by constant current is especially adapted to effect these objects, and has been specifically claimed herein, although my generic claim is intended to cover a system adapted for both kinds of current. In a system operated with constant current broken conductors may be used, and the switch above the car, whether it is at rest or in motion, will operate, as just stated, to wholly cut off the current from the car-switch, and to therefore exclusively control its movement. The broken conductor below such landing-switch becomes practically dead, and thereby destroys one of the connections necessary to the operation of the car-switch. I do not, however, limit myself to the use of broken conductors in cases where car and landing switches are both required, as the switches may be operated without such continuous conductor although not with the same convenience. If the continuity of some conductor connected with a landing-switch (in the system with con-

stant current) were not broken, any landing-switch beyond the car-switch would not operate when the car-switch was in its normal position, as the car-switch then short-circuits the motor; but the breaking of the circuit through the conductor, in a loop thereof, by means of the landing-switch, when shifted to operate the motor, destroys the short circuit through the car-switch, and enables the landing-switch to control the current. The number of discontinuous conductors employed to operate a car-switch and landing-switch in the same circuit is not material, as the construction may be varied with the winding of the motor and the class of current employed; nor is it material which of said conductors is broken, the conductor 1 being shown with breaks 13, in Fig. 5, and the conductors 3 and 4 being shown discontinuous in Fig. 7.

The diagram in Fig 9 is drawn to illustrate the effect when all the switches are moved at once into an operative position; the arrows marked a^2, b^2, c^2, d^2, e^2, f^4, g', h', i, j, k^6, and l^{10} show the path of the current to conductors 3 and 4, the current passing through the armature from conductor 2 to 1 and then branching off at different points into the paths formed by the various switches. The effects shown are produced in a system operating by constant current, but when operating by constant potential there is a liability to short-circuit the current, as shown in connection with Fig. 4, and the safety-plugs are therefore required to prevent damage to the dynamo furnishing the current.

The diagram in Fig. 10 is drawn to illustrate the construction for a system with constant current when landing-switches alone are used. Such a construction would be most suitable for freight-elevators, where no regular attendant would be employed to attend the car; but it would have to be brought to and dispatched from the different landings by the use of switches thereat. In such case it would be possible to secure the stoppage of the car at any particular landing by providing a landing-door and a door-switch thereat, or a switch analogous to the door-switch arranged to be operated by hand at such landing, so that the car when dispatched from any other landing would stop thereat. In such a system it would also be very important to provide an automatic stop at each end of the course to prevent the fouling or breakage of the suspending-rope. It will be noticed that the dogs d' and switch-stud d (shown in Fig. 1) would not operate to stop the car if it were moving under the control of the landing-switch, as the only function of the dogs is to throw the car-switch into a neutral position, and such neutral position is the normal position in which it is controlled by the landing-switches. Where landing-switches are used it is therefore necessary to provide means independent of the car-switch or any dogs for shifting the same to stop the car positively at the top and bottom of the hoistway. I have shown herein switches adapted to be shifted or actuated by a projection upon the car when the latter reaches the proper limits of its travel. Such switches are shown in Fig. 6 at $y\,y'$, the switches being inserted in branches between the line-wires 7 and 8, so as to short-circuit the motor when closed. The switches are held normally open by springs y^2, and are provided each with an arm y^3, having a stud or pin y^4, projecting in the path of a wedge y^5, attached to the moving car. The switch is so located that when the car reaches the desired limit of its travel the wedge operates to shift the switch and to stop the motor, thus preventing any accidents if the car is not properly governed by the operator. The short circuit thus formed cuts out all the car and landing switches, and means must therefore be provided for reopening the circuit through such switches before the motor can be started to move the car from its position. Such means would consist in a spring-closed switch adapted to open the short circuit formed by either of the switches $y\,y'$, and located upon the landing, where it could be held open by the operator until the car could be moved from its contact with the switch y or y'. Such spring-closed switches are indicated at $x\,x'$, adjacent to the switches $y\,y'$, and a mere push-button would be used in practice, and would be arranged to normally close the circuit just as the switches $y\,y'$ operate normally to open it. Stop-switches operated in a similar manner are shown in Fig. 10 at y^{41} and y^{51}, each switch consisting of two spring-leaves connected, respectively, with the conductors 7 and 8, and joined electrically, when the car reaches the limit of its travel at either end of the hoistway, by a metallic plate y^6 upon the car T. In Fig. 4 a similar plate c^{10} and springs c^{11} are connected with the locking-magnet L. The switches $x\,x'$ are in Fig. 10 shown applied to breaks in the conductor 8, the switches being shown closed and provided each with a push-button adapted to open it when required. These switches may be located at x^3 in a loop of the line 8. These stop-switches y, y', y^{41}, and y^{51} may be used to stop the car automatically at the ends of the hoistway in place of the means shown in Figs. 1 and 3 for shifting the lever of the car-switch. A freight-elevator, such as is shown in Fig. 10, may also be started at any landing and automatically stopped at an intermediate point by means of door-switches at the landings operated by opening the doors, as just described above. In Fig. 10 three landing-switches are shown adapted to operate by constant current, each being constructed with three springs attached to the switch arm or lever and bearing upon three separate segments. Such landing-switches would be connected merely by wires, and no conductors would require to be fixed in the hoistway. I have, however, numbered the wires the same as the constant-current conductors shown in Fig. 6. The segment l

in the switch nearest the motor is connected to conductor 3, the segment m is connected with the conductor 1 from the brush B′, and the segment n with the conductor 2 from the brush B. The switches are shown arranged to be normally connected in series by a spring o, bearing upon the segment l and upon a stud l', adjacent to the segment and connected by a wire l^2 with the similar segment of the succeeding switch, the segment of the last switch in the series being connected by wire l^3 with line-wire 8. Adjacent contact-studs m' and n' are connected with segments m and n and adapted to throw the current from the segment l and spring o into the conductors 1 and 2, respectively, when the spring is moved to such studs. Springs r and s bear, respectively, upon the segments m and n, and contacts r' and s' are arranged adjacent to the same and connected, respectively, with the conductors 1 and 2, the springs operating normally to close loops or breaks formed in each of the said conductors, but adapted when moved to connect either of said conductors with the stud l' and with the wire l^2 and negative line-wire 8. The upper switch is shown in its normal position. The center switch, arranged below it, is turned to the right, and the lower switch is shown in full lines in its normal position in dotted lines turned to the right, and in wavy lines turned to the left. Between the segments m and n are shown contacts b^6, in line with the space between the segments r' and s', and connected with the same when the switch-arm is moved into an operative position to move the car up or down. The contact b^6 of each switch is connected by wire a^6 with the contact l' of the switch below, and operates, when more than one of the switches is by accident turned at the same time, to maintain a path for the current to the positive and negative line-wires to prevent a break in the circuit. Such break would be very injurious with a constant-current circuit, and would otherwise occur under such circumstances, as will be seen by following the arrows in dotted and wavy lines which are applied to the drawings. When the center switch is turned from its normal position, as shown, the current passes from such switch by the black arrows to the armature-brush B, and from the armature-brush B′ back to the contact m in the center switch, from which it passes through the stud l' and connection l^2 to the segment l of the lower switch. From this segment, if the lower switch were in its normal position, the current would pass to the stud l' and through the connection l^3 to the negative line-wire 8. It will be seen by inspecting the center switch that the current returning to the switch from the armature passes from the segment m or n (according to the position of the switch-arm) to the stud l' by a connection c^6, and if the lower switch receive the current from the armature the current would enter segment m or n and pass thence to the stud n' or m', and through the spring o into the stud l' to reach the line-wire 8; but when the lower switch, or the one farthest from the motor, (and which forms normally the connection for all the other switches to the line-wire,) is displaced simultaneously with any other switch in the series its spring o is disconnected from the stud l' and line-wire, and other means are required in each of the other switches to form such connection. Such means are provided in the wire a^6, which connects the stud b^6 with the contact l' of the switch below it in the series. When the lower switch is moved to the position shown in dotted lines, the current would be compelled to follow the course indicated by the dotted arrows to contact s' of the switch above it, and would be there connected by the spring r or s (according to the position of the switch-arm) with the contact b^6, from which it could pass by the wire a^6 to the contact l' of the switch below it, and thence through conductor l^3 to the line-wire 8. The same results follow when the lower switch is moved to the position shown in wavy lines, the wavy arrows showing the current led to the contact r' of the switch above it, and thence through the stud b^6 and wire a^6 to the negative line-wire, as before. With this construction when the center switch, or one nearer to the motor, is operated to actuate the motor, the moving of a lower switch in the series does not prevent the switch in advance of it in the series from operating in the intended manner, nor does it prevent the current from such earlier switch from reaching the negative line-wire, as is required. The path traversed by the current, as indicated by the dotted and wavy arrows, is simply the path that the current is required to follow after leaving the center or earlier switch. It is obvious that the switch nearest the motor would receive the current from the conductor 3, and would affect the operation of the motor to the exclusion of any other switch in the series which might be turned at the same time. It will be seen that with switches thus constructed, and automatic stop-switches at the ends of the hoistway, my construction is completely adapted to prevent the derangement or interruption of the circuit, or the stoppage of any other apparatus connected in series therewith, and is so designed that it may be operated by any persons who would be trusted with the management of any form of power-elevator.

The system shown in Fig. 10 is adapted for dumb-waiters or hoisting-apparatus of any kind actuated from stationary landings, and when such switches are operated singly each one is capable of controlling the car at any part of its course, owing to the absence of a car-switch, which, as has been described above, operates to cut out the landing-switches when situated between any of the same and the motor connections.

Fig. 11 shows an arrangement with circuits and switches for actuating the car by hydrau-

lic mechanism through the agency of an electric motor, the motor shown being of the reversible type and connected with a reversible rotary pump. The movement of the car in this construction is as much dependent upon the movement of the motor, and therefore upon the switches used to change the circuit connections, as in any other of the systems heretofore illustrated.

In Fig. 11, M is the electric motor, shunt wound; P^{12}, the rotary pump; P^{13}, a water-reservoir with weighted plunger P^4, and P^5 a cylinder having a piston-rod P^6 and pulley P^7 to actuate the rope L^4 for the car L^5. The pump operates, according to the direction of its motion, either to draw the water from the reservoir and force it into one end of the cylinder to pull the rope and hoist the car, or to draw the water from the same end of the cylinder into which it was forced, and deliver it back into the reservoir under the pressure of the plunger P^4 to lower the car. The plunger is weighted to such pressure as to overbalance the empty car, and to thus furnish to the pump a current of fluid under suitable pressure to materially assist in elevating the load. The work thrown upon the motor when lifting is thus greatly diminished, and some of the work is imposed upon it when lowering the car. The switches are shown for a constant-potential circuit, the switch-lever M^1 upon the car being formed of non-conducting material, with metallic plates m^6 and m^7, and the switch being formed with three sets of segments, lettered, respectively, n^6 connected with the conductor 4, n^7 connected with the conductor 2, and n^8 connected with the conductor 1, and with two sets of resistances n^9, connected with the conductor 3. The conductors are shown as if fixed stationary in the hoistway and the connections for it made by moving contacts $1'$ $2'$ $3'$ $4'$. The conductors 1 and 2 are connected with the commutator-brushes, and the conductors 3 and 4 are connected primarily with the positive and negative line-wires and with the opposite terminals of the field-coils. The car-switch operates when moved from its normal position to the right to throw a portion of the current from conductor 3 into the conductor 1, and thence through the armature into conductor 2, and through segments n^7 and n^6 into conductor 4 to the negative line. When moved in the opposite direction, the current passes from the conductor 3 to conductor 2, and thence through the armature to conductor 1 and 4, thus reversing the motion of the armature and of the pump in the desired manner. The landing-switch is provided with lever O^6, having a metallic plate o^7 near one end fitted to connect, respectively, segments o^{10} with resistances n^{10} and segments o^{11} with the resistances n^{11}, a plate or spring o^8 at the opposite end of the lever being adapted to bear upon the segment opposite that in contact with the plate o^7. The resistances are all connected with conductor 1, the segment o^{11} with the conductor 3, the segment o^{10} with the conductor 4, and the plate o^8 with the conductor 2, and the lever operates when shifted to the right and left to effect the same changes in the circuit as the lever of the car-switch.

Hydraulic mechanism for operating elevator-cars is already so widely used in so many modifications that it is obviously immaterial what kind be employed in my electric system to produce the motion of the car, provided the motion of the hydraulic hoisting apparatus be controlled by electric circuits and switches in the manner shown in any of my different drawings, or described herein. I have merely shown the construction in Fig. 11 to illustrate one form of my invention, and it is immaterial whether a reversible pump be used or whether the electric motor and pump be employed merely to elevate the car, and the descent of the same be secured by discharging the water from the hydraulic cylinder, or whether the hydraulic mechanism be actuated by a water-motor and the movements of the motor controlled by a magnetic switch and electric circuits, as shown in Fig. 14.

Fig. 12 shows the application of my invention to electric circuits and switches, in combination with a motor running constantly in one direction and connected with a hoisting-drum by a belt or belts which require to be shifted to and from the fast pulley which drives the elevator. In such case my system of circuits and switches is employed to actuate an electro-magnetic shifter to act upon the elevator-belt and to move the same to and from the fast pulley. In the drawings only the armature A^5 of the motor is indicated with the bed M^5 for the entire motor and the binding-posts p^5, which receive the current from the segments of a hand-switch interposed in the positive line-wire which is connected with one of the terminals of the field. C^5 is a counter-shaft driven continuously by the motor, and B^5 and B^6 are straight and cross belts driven by the counter-shaft and shown resting upon loose pulleys B^7 on the elevator-driving shaft B^8. A fast pulley B^9 is shown upon the shaft between the pulleys B^7, and a shifter B^{10} is shown applied to both the belts and operates, when moving one of the belts upon such fast pulley, to move the other away from it upon the adjacent loose pulley. The shifting device consists of an electro magnet or magnets M^6, with opposite poles N S, arranged at a suitable distance to admit between their pole-pieces N S a rotary electro-magnet M^8, which is held normally with its poles at right angles to the poles of the magnets M^6 by an arm A^6 and weight W^6, the coils of the armature being then at right angles to the coils of the magnets M^6. As shown in the drawings, the current, when the lever s^7 of the hand-switch connects the segments s^5 and s^6, passes from the line to the motor and from the motor to one terminal of

the coils around the magnets M^6, but passes only through the rotary magnet or armature M^8, when the current is directed through the same by circuits and switches arranged according to my system. In this Fig. 12, C^7 is the car, and 1 2 3 4 conductors arranged in the hoistway, with sliding contacts $1\frac{1}{2}$, $2\frac{1}{2}$, $3\frac{1}{2}$, and $4\frac{1}{2}$ connected with a switch upon the car. The switch is provided with four segments, s^8 connected with conductor 1, s^9 connected with conductor 2, s^{10} connected with conductor 3, and s^{11} connected with conductor 4, and with a lever l^8, carrying two curved springs, insulated from one another and adapted each to bear upon three of the segments when in their neutral position, as shown in the figure, but to unite only two of such segments when moved into an operative position in either direction. The switch is thus adapted for constant current, as it avoids opening the circuit in either direction, while it operates, like the car-switch shown in Fig. 1, to throw the current from conductor 3 alternately into conductors 1 and 2 to reverse the current in the circuit, and to thus actuate the hoisting mechanism in contrary directions, as desired. When the top of the car-switch lever is turned to the left, as per arrow marked "left," the current passes, as indicated by the arrows l^9, from conductor 3 into conductor 1, which is connected flexibly with one terminal of the coil about the rotary armature M^8, and from the other terminal of such coil to the conductor 2, and through the switch-segments s^9 and s^{11} into conductor 4. The movement of the lever l^8 in the opposite direction diverts the current through the armature M^8 in the opposite direction. The poles of the fixed magnet are indicated by the usual signs N S; but as the rotary armature is very nearly circular in cross-section but very slight rotary tendency is produced by the attraction of such poles until the circuit through the armature is closed. When the armature becomes magnetized with poles at right angles to the poles N S, there is a strong tendency to rotate in the effort of the currents around the armature to place themselves at right angles to the lines of force in the field between the poles N S. The armature lever or arm A^6 is connected with the belt-shifter B^{10}, and the motion of the armature in one direction is utilized to throw the straight belt upon the elevator-driving pulley B^9, and to thus hoist the car, while the reversal of the current in the armature and its movement in the opposite direction is utilized to push the straight belt off the fast pulley and to move the crossed belt thereon to run the car down. Only the car-switch is shown in Fig. 12, as in Fig. 1; but landing-switches alone may be used, if required, as in Fig. 10, or the entire system, with car and landing switches, door-switches, door-locks, and automatic stop mechanisms shown herein may be connected with the circuit and operated as described herein. It is obviously immaterial whether the reversible current be directed through the coils of the rotary armature or through the coils of the fixed magnet or magnets to effect the desired movement in the armature lever or arm A^6, and it is obviously immaterial whether an arm be used to actuate the belt-shifting mechanism or a rack and pinion or other equivalent mechanism be employed.

Fig. 13 shows the arrangement of currents and switches for a constant-current system, in which a flexible conductor or cable is used to convey the current to the car. The motor is series wound with the coils of the solenoid-brake magnet M′ in a circuit passing from one of the armature-brushes to the wire 13′, connecting with the car and landing switches. The conductors 1 and 2 are merely insulated wires connected with the opposite armature-brushes. The conductor 3 is connected with the negative terminal of the motor field-coils and the conductor 4 with the negative line-wire. Lines L^2 represent landings at different heights in the building, with landing switches applied to the first and third landings and the car shown situated at the level of the second landing. The car-switch is the same as that shown in Fig. 1, (a constant-current system,) but the landing-switches are constructed with merely two segments K and K′, connected, respectively, with conductors 2 and 1 and having a contact v connected with wire 12′, leading through the flexible cable to the contact 35 of the car-switch and connected normally with conductor 1. Adjacent to each of the segments is a contact q, connected with the conductor 4, and thus with the line 8, and a contact q', connected with the conductor 3, and through wire 14′ with the lever 33 in the car-switch. The landing-switches, when their levers provided with the contact-springs K^7 and K^8 are turned to the right and operated independently of the car-switch, thus serve to connect the conductors 3 and 2 to throw the current into the brush B′ and at the same time to connect the conductor 1 and brush B with the conductor 4 and line 8. When turned to the left, the arms of the landing-switches connect the conductor 3 with conductor 1, and also connect the brush B′ with the conductor 4 and the line 8. The parts lettered 33, 34, 35, and 20 in the car-switch are connected, as in Fig. 1, with the conductors 3, 4, 1, and 2 by means of the wires 14′, 15′, 12′, and 13′. Assuming that the car-switch be turned to the left to run the car down, the current then passes through the cable from the field-terminals by wire 14′ to the lever 33, thence through wire 12′ to contact v and spring k^8 of the landing-switch, and through contact K′ to conductor 1 and brush B. After passing through the armature the current passes from the brush B′ and brake-magnet M′ by the wire 13′ through the cable to the contact 20 and lever 34. It then returns through the cable by wire 15′ to the conductor 4 and line 8. When the car-switch is turned in the opposite direction, the current in the

motor is reversed and the same effects produced as by the car-switch shown in Fig. 1. The landing-switches are shown connected mechanically by bell-crank u and a link u' to secure the opening of the circuit at all of the contacts c when any one of the landing-switches is operated

The car-switch will operate in connection with a landing-switch with the construction shown if only one landing-switch is used; but if more than one be connected with the circuits, as shown in the figure, the movement of any one of the landing-switches will not suffice to control the current, as it is necessary in such case that the circuit through the car-switch should be broken. This is effected in each landing-switch by moving the spring k^8 from the contact c; but the movement of one of a series of landing-switches will not suffice to open the circuit through the car-switch unless the others be moved at the same time, for which purpose the bell-cranks u and link u' are shown. In lieu of such mechanism for operating all the landing-switches at once the landing-switches may all be connected in series, as is indicated by the wavy line c', connecting the contact c in one switch with the spring k^8 in the switch below it. With this construction the circuit to the car-switch passes through contact c of each switch to the spring k^8 of the switch below it, and the circuit may thus be completed through any number of landing-switches. The movement of any one of the landing-switches will therefore open the circuit through the car-switch, and the current will follow the path through the particular landing-switch that is moved. The wires 5 and 6, connected, respectively, with the brushes B′ and B, are provided for the connection of indicators k at the landings, such as are shown in connection with the same wires in Fig. 6.

In all the systems shown in Figs. 1 to 13 the same current that passes through the motor-armature is conveyed by the circuits to the various operative switches in the car or at the landings. While this arrangement is most simple, it is obvious that as my system consists in the combination of circuits and switches such combination may operate with an independent electrical generator, and that the current operating in the circuit from such independent generator may be employed to actuate a reversing-switch placed in the motor-circuit, and thus control the operations of the hoisting mechanism actuated by the motor. Such a construction is shown in Fig. 14, the conductors being shown at 1, 2, 3, 4, 7, and 8, the car-switch connected with the conductors by a cable, and the independent generator G^3 being connected with the switch upon the car and with a landing-switch connected with the conductors 1 2 3 4. M is the magnet of the motor, which is shunt-wound and with a circuit and motor-switch Z, adapted to a constant-potential system. The current is shunted through the field from the + line-wire 7 by wires a^{11} and a^{12} and through the motor-switch Z by wires b^{10} and b^{15}, which are connected, respectively, with segments 19 and 20 in the switch Z, which is constructed and operated the same as the switch shown in Figs. 4 and 5. The switch-lever carrying the contact-pieces or springs f' and f^2 is shifted by a link f^{10}, which is actuated by an electro-magnetic shifter (indicated by the letter Y in Fig. 14, and shown in detail in Figs. 15, 16, and 17.) In the latter figures, E E are the poles of a stationary magnet; F F, the poles of a movable magnet pivoted to turn in relation to E E and normally held at right angles to the same by a weight W. This electro-magnetic shifter operates electrically the same as the one shown in Fig. 12, but mechanically is of different construction, as it is provided with brushes resting upon movable contact-pieces to convey the current to the cores of the movable magnet from the independent generator G^3, and the magnet and armature cores being formed in pairs connected by bridges. The current passes from the independent generator G^3 by the wire e to the coils of one pole E, and from thence by wire e' to the coils of the other pole E, as shown in Fig. 15, and from thence by wire f^{21} to the conductor 2. The conductors 1 and 3 are connected, respectively, by the wires f^{12} and f^{11}, with the brushes g^{10} and g^{11}, resting upon the segments h^{10} and h^{11}, which are in electrical connection with the coils of the movable magnet-poles F. The conductor 4 is connected with the wire f^{14} of the generator G^3.

The car and landing switches shown at X and X′ are similar to the switch Z and to the constant-potential switches in Figs. 4 and 5, and have their several contacts lettered the same as in Figs. 4 and 5 and connected with the same conductors. The movement of the switch X or X′ operates to vary the current in the circuits through the brushes g^{10} and g^{11} the same as the switches connected with the armature-brushes B and B′ in Figs. 1 to 13, inclusive, and the current around the movable magnet-poles F is therefore reversed at pleasure, with the effect of reversing the polarity of such poles and causing them to be forcibly attracted or repelled by the poles of the fixed magnet E E. As shown in Figs. 15 and 16, the bridge of the poles F is formed with extensions at opposite sides to carry upon the one hand the weight W and upon the other hand the link f^{10}, by which the motion of such bridge (when the poles F are retracted or repelled) is transmitted to the operative arm of the motor-switch Z. By such connection between the electro-magnetic shifter and the motor-switch the latter is moved at the same time in the same direction with either of the switches X or X′, and thus varies the current in the motor-circuit the same as if such circuit were connected directly with the car or landing-switch. It is obviously immaterial how the electro-magnetic shifter be caused to operate upon the

motor-switch; but it will be readily understood that the axis x^3 of the switch Y might be in practice made coincident with the axis x' of the switch Z by mounting the magnet F upon the same stud that carries the arm of the switch Z. In such case it would not be necessary to employ a link, as f^{10}; but the arm of the switch Z could be connected directly to the bridge of the magnet-poles F.

It is obvious that in the system shown in Fig. 14 the car-switch may be connected with the electric circuit by sliding or rolling contacts moving over fixed conductors in the hoistway, as in Figs. 1 to 9, inclusive, the circuits being conducted to the car by a cable in Fig. 14 merely to show the connection of a constant-potential circuit with the car-switch equivalent to the arrangement of the constant-current circuits shown connected with the car by a cable in Fig. 13.

In Fig. 5 door-switches e^3 are shown formed in a loop of the conductor 4, the ends of the loop being connected with the conductor at each side of a break e^4, formed in the said conductor above the path of the sliding contact 15. As such figure shows circuits adapted for constant potential, such door-switches would be held normally closed, and may be actuated by any suitable connection to the door to open the circuit, and to thus prevent the actuation of the motor until the door is closed.

In Fig. 10 switches are shown in a loop of the —line-wire 8, which would be held normally closed, as by a spring push-button, and which may be used instead of the switches $x\,x'$.

In Fig. 13, in addition to the shifting-blocks d' for automatically shifting the switch-lever 33 upon the car at the end of its travel, the stop-switches $y\,y'$ are shown arranged similarly to those in Fig. 6, and could be used to stop the car in place of the means for shifting the car-switch automatically, if desired. In such case they would be held normally open and operated by wedges y^5 upon the car, as shown in Fig. 6.

In Fig. 13 door-switches e^6 held normally open are shown in a branch circuit between the line-wires 7 and 8, the one on a level with the car T being shown closed, as would be the case if actuated by a connection to the open door when the car was stationed at the landing to short-circuit the motor. The same switches upon the first and third landings are shown open, as would be normally the case so long as the doors at such landings were closed. When landing-switches are not used, as in Fig. 1, the door-switches may be connected with the same conductors upon which the sliding contacts of the car are arranged to move, the connections for such switches being attached at each landing, so that the opening of the door-switch may cut off the current from such contacts and the car-switch connected therewith. When landing-switches are used, the connections thereto will cut out the door-switches which may be located beyond them, and thereby render them inoperative, and the arrangement shown in Fig. 18 may, if desired, be used, consisting in a single switch e^6, connected with a branch of the main circuit above the highest landing-switch and actuated by mechanism as the wire or rod e^7 and cranks e^8, located at the separate landings. Rods e^{12} receive the thrust of the door, and springs e^{13} press rods toward door. Separate door-switches may also be used, as shown in Fig. 13, arranged at the different landings, but located in a loop of the — line 8, so that they are wholly removed from the variations in the current which are effected by the landing and car switches upon the conductors with which they are connected.

The car T in many of the diagrams is shown without any hoisting-rope or means of connection to the hoisting apparatus; but in other cases, as in Fig. 10, a mere suspension of the car from a drum is indicated, and a belt connection from the drum to a pulley upon the motor-armature shaft.

In Figs. 4 and 11 various means are shown for transmitting the motion of the electric motor to the car, and it is obvious that in those cases where the connection of the motor with the car is omitted it may be readily supplied by any of the means that are shown or any other suitable hoisting mechanism. The brake-magnet M′ is also shown in most of the diagrams applied to a brake-wheel P′, and it will be understood that such application may be made at any point in the hoisting mechanism where it will be most convenient or effective.

It will be understood that in the diagrams the brake is pressed normally against the brake-wheel, as by the weight P^3, and thus tends to hold the hoisting mechanism motionless; but as soon as the current passes through the armature it operates to lift the brake from the wheel, and to thus permit its rotation while the motor is in operation. This construction is shown in the drawings because it is the safest, for if the brake-magnet fails to act from any cause the hoisting mechanism will simply be restrained from motion and no accident to the car could occur. On the contrary, if the circuits be so arranged that the current would pass through the brake-magnet when turned off of the motor and operate to release the brake when the motor is in operation, then a failure of the brake-magnet to operate would deprive the hoisting mechanism and the suspended car of the entire restraint imposed by the brake and serious accidents might result. It is, however, immaterial to my invention whether the brake be actuated or lifted from the brake-wheel by the electro-magnetic energy.

When fixed conductors are used in the hoistway and moving contacts are attached to the car to carry the current to a car-switch, it will be understood that it is preferable to have one or more of the fixed conductors discontinuous or provided with breaks, as shown at 13, 30, and 31 in Fig. 7, so that the move-

ment of the landing-switch may cut off the circuit through the car-switch, and thus prevent the latter from operating. It will also be noticed that in most of the constructions having a car-switch and landing-switches when two of the landing-switches are turned to make the car move in the same direction the car will move; but if two switches are shifted to move the car in contrary directions the car will not be moved, and in case a short circuit is produced in a system with constant potential a fuse will be required at some point in the connections to prevent damage to the dynamo which furnishes the current. It will also be noticed that where a landing-switch is used to normally close a circuit around a break in one of the car-switch conductors the movement of such landing-switch opens the circuit at such break, and the portion of the conductor beyond such landing-switch is wholly cut off from the current, and the car-switch, when the car is located beyond such break in the conductor, is wholly inoperative by its connection with such dead conductor and the movement of the car is controlled entirely by such landing-switch.

Many of the differences of construction shown herein are due merely to the provision required in circuits with constant current to avoid opening the circuit at any point, while in a system operated with constant potential the circuits are normally open and no current passes through a switch until moved, and if the motor is series wound it is not magnetized at all until a switch is moved; but with compound or shunt-wound motors the circuit through the field remains undisturbed by the operation of the switches, and all the changes necessary to operate the car either by the car or landing switches take place in the armature-circuit.

Although the shunt-circuit around the field is shown normally closed in the diagrams for constant potential, it is obvious that the circuits and switches could be so arranged as to cut the whole motor out of the circuit the same as with the constant-current system; but such an arrangement would be more complicated, and the advantage, except in cases where the elevator is seldom used, would not be sufficient to compensate for the additional cost of construction and liability to derangement.

My object in this entire elevator system has been to make it as complete as possible in respect to its simplicity, durability, and the certainty of its action, and at the same time avoiding needless complication. I do not therefore limit myself to the use of all the attachments, as landing-switches, door-locks, indicators, and automatic stops at the top and bottom of the hoistway, which I have described herein, but believe that the conditions frequently exist under which they would be desirable and necessary. Thus where an elevator is used in private houses it may frequently be operated by ladies, who could bring the car to any required landing by operating the switch fixed thereon, and in such cases it would obviously be very necessary to employ an automatic lock to hold the landing-door normally fastened until the car reached such landing, as by the bolts shown in Figs. 1 and 4.

Where no operator is employed to constantly ride upon the car and open the landing-doors from the inside, it is obvious that the door must be wholly unlocked, or some class of lock actuated by the car when it reaches the landing must be employed to prevent inexperienced persons from accidentally opening the door and walking into an open hoistway. Devices not magnetically operated may be employed to effect such result, and such a mechanical door-lock is shown in Fig. 4. v^3 is the bolt of the lock, which would be fitted through the door-frame, as shown in Fig. 1. v^4 is a bell-crank having one arm attached to the bolt and the other arm attached to a simple lever v^5, pivoted at w^3, and provided with a roller v^6 upon its free end to bear upon a seat w^4, formed on the side of the car. Such seat is formed with sloping sides and adapted, when the car approaches its resting-place at the landing from either direction, to press the roller sidewise and draw the bolt from the door to release the latter. Upon the car T in the same figure is shown the magnet L for a lock similar to that shown in Fig. 1, the electrical circuit through the magnet being connected with the wires 7 and 8 and closed by a plate c^{10} upon the side of the car when at the landing. The mechanical lock and the electrical lock are both shown in this figure applied to the same door merely for convenience of illustration; but it is obvious that in practice only one lock would be applied to the same door, and that either system of locks would be applied to all the landing-doors upon the same hoistway.

It will be noticed that in the constructions described above for operating with conductors fixed in the hoistway and provided with breaks, as 13 in Figs. 5 and 6, or 30 and 31 in Figs. 6, 7, 8, and 9, the effect of the landing-switch upon the car-switch is such that if the switch below the car is moved to make the car go up the car will stand still, as the connections are designed only to bring the car down from an upper landing to such lower one. On the contrary, if the car be below the landing, the switch cannot be operated to make it go down; but if the car is either above or below the landing the switch will operate only to set it in motion toward that landing. If the switch is turned in the wrong direction, the car will not move. In consequence of such construction, when a landing-switch is properly turned to bring the car to such landing, the car will stop of its own accord when moved to such landing, because one or more of the contacts 12, 13, 14, or 15 will pass over the brakes in the discontinuous conductor and lose the electric current. Such operation of

the switches when turned in the wrong direction will be perceived by tracing the course of the currents in Fig. 9, where the various switches are turned contrary to one another. To effect such result the break in each conductor is so constructed that the contact will pass over it just before or after the car is even with the landing. By such construction the car may be brought to the landing when moving in either direction, for if it lost the current just before reaching the landing the car would possess sufficient momentum to carry it thereto.

In all the figures except Fig. 18 the desired movements of the hoisting mechanism are effected by controlling the armature-circuit through the operation of the car or landing switches; but in this figure variations in the course of the current affect the magnetic field instead of the armature. In Fig. 18 the circuits are so arranged that the current passes continually through the armature and is cut off (to stop the motor) or reversed (to actuate it in opposite directions) by varying the course of the current in the field-coils. In some cases this is the best arrangement, as the resistance of the armature is much less than that of the field, and consequently absorbs much less energy when the motor is standing still. The electrical conductors and all the connections from the same to the car or landing switches would be unchanged in such a system, the alteration consisting merely in reversing the relations of the field-coils and commutator-brushes to the system by connecting the conductors 1 and 2 with the terminals of the field-coils, and the + line-wire being then connected to one of the brushes and the other brush being connected to conductor 3.

By comparing the connections of the conductors 1, 2, and 3 with the motors in Figs. 1 and 18 the character of the change will be apparent, and, indeed, is so simple as to be readily effected by changing the wires to any motor which is already connected with the conductors by the arrangement shown in Fig. 1.

The indicators k^2 are shown only in Fig. 6; but it is obvious that they may be connected with a branch circuit of varying electro-motive force in the systems illustrated in any of the other figures. In like manner the means (wedges d') for shifting the car-switch automatically are shown only in Figs. 1 and 13, but may be applied to any of the constructions shown in the other figures, and to avoid the risk of accident in case such mechanism should not operate the switches y^4 and y^5 (shown in Fig. 10) may be used in addition to the mechanism shown in Fig. 1 for stopping the car at the ends of its normal travel.

In Fig. 6 a different construction for cutting out the motor at the ends of the car's travel is shown in the switches y and y', which may be substituted in any construction for the switches y^{41} and y^{51} shown in Fig. 10, the switches x x' shown in Figs. 6 and 10 being requisite in either of such latter cases to restore the current to the operative circuits traversed by the switches until the car is moved from its contact with the cut-out switch.

A brake-magnet M′ is shown in the motor-circuit in nearly all the figures and operated the same as is described for Fig. 1, and the motor in nearly all the figures is represented merely by diagram, showing the armature and field magnet and the car by a mere rectangle with or without any apparent means of connection with the hoisting mechanism, it being understood that the car or hoisting-platform would be constructed of any desired shape and connected with the hoisting mechanism in any convenient manner.

I am fully aware that where an electric motor has been used to actuate an elevator-hoisting machine the brake connected with such hoisting apparatus has been magnetically operated and its operation controlled by a switch upon the car. In such case the function of the switch is merely to cut off the current from the brake-magnet, and such switch has no effect whatever in applying the power to the hoisting apparatus or removing the power therefrom.

While a brake may be said in a certain sense to control the movements of a hoisting apparatus, it is only by resisting the power or force exerted by such apparatus, and it may therefore operate while the armature of the electric motor is rotating and reduce the speed of such armature by a wasteful expenditure of force, or it may operate in a similar wasteful manner when the hoisting mechanism is rotated merely by the descent of the load. In neither case does the brake-switch affect the application of the power to the hoisting apparatus as in my invention. It will therefore be seen that the motor or other electro-magnetic device which is affected by the current passing through the circuits and switches of my system is generically different from a brake, and that any of my switches furnishes a means of applying the power to the hoisting apparatus or withdrawing such power from the same, and may be used either to stop or start the hoisting apparatus or to reverse its motion, if desired, while simultaneously actuating the brake.

Where the motor for operating the hoisting apparatus is placed in circuit with other apparatus, as in systems for the distribution of light or power by an electric current from a central station, it is obvious that the current in the circuit would be kept either at constant potential or constant strength, and that the apparatus would require to be connected in multiple arc with such circuit or arranged in series with the other apparatus therein. In the former case the switches would in my construction be provided with artificial resistances to avoid throwing the current into the electric motor until its armature-rod set up a counter electro-motive force, and in the latter case the switch levers or connectors

would require to connect the adjacent contacts in the switch when moved from one to another to prevent an open circuit.

I hereby disclaim the mere actuation of a brake by an electro-magnet having its coils in a circuit connected with a switch upon the car. In the construction I have shown herein to operate with constant current it will be understood that the circuit cannot be opened even if all the switches are moved at the same time, and that the switches adapted for a current of constant potential are shown in all cases provided with the resistances *r* to prevent the current from flowing into the motor until a counter electro-motive force is set up therein.

While I have claimed the electrical system herein described without reference to the use of any particular form of switch or arrangement of switches, I have in the three other applications referred to herein made specific claim to circuits to operate expressly with landing-switches, and have in such applications claimed many of the details of construction which are shown herein but not specifically claimed.

Having thus set forth the nature of my invention, what I claim herein is—

1. In an electric-elevator system in which the motion of an electric motor is transmitted to the car by means of a hoisting-pulley, intermediate mechanism, and a hoisting-rope, the combination, with the motor-circuit, of a switch located upon the car and arranged and operated to reverse the motion of the car by reversing the motor and to stop the car by stopping the motor, substantially as herein set forth.

2. In an electric elevator system, the combination, with a suspended car moving in a hoistway provided with landings, of hoisting mechanism operated by an electric motor, electrical conductors, and a circuit connecting the motor with the car and with the said landings, and switches upon the car and upon the landings connected with said circuit and provided each with contacts and with a movable lever or connector adapted to vary the course of the current in the motor, as and for the purpose set forth.

3. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, electrical conductors, and a circuit connecting the motor with the car, a car-switch located therein to control the movements of the hoisting mechanism, and a door-switch located in a branch of such circuit and operated by the opening of the door to stop the motor, as and for the purpose set forth.

4. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a motor-circuit supplied with a current of constant strength, circuits interposed between one or both of the terminals of the field and the armature and between the armature and one or both of the terminals of the line, and one or more switches located therein and arranged in or along the path of the car and operated to reverse or stop the movement of the armature, as herein set forth.

5. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a motor-circuit supplied with a current of constant strength, a car-switch located therein to control the movements of the hoisting mechanism, and a landing-switch located in such circuit and operating normally to complete said circuit, as and for the purpose set forth.

6. In an electric-elevator system operated by a constant current, the combination, with a suspended car moving in a hoistway having landings and landing-doors, of an electric motor and hoisting mechanism operated thereby, a motor-circuit, and door-switches arranged in the said circuit and operated by the opening of the doors to short-circuit the motor and to thus stop the same until the door is closed, substantially as set forth.

7. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, an electric circuit for operating the motor, a car-switch located therein and operating normally to stop the said motor and when moved in opposite directions to close reverse circuits through the motor-armature, and a door-switch located in a branch of such circuit, and operating, substantially as described, to stop the car by the opening of the door when the car is moved to such door by the shifted car-switch, and adapted when the door is closed to complete the circuit through such shifted car-switch and start the car in the same direction, substantially as herein set forth.

8. In an electric-elevator system, the combination, with a suspended car moving in a hoistway provided with landings, of hoisting mechanism operated by an electric motor, electrical conductors fixed in the hoistway and connected with an electric generator and with the motor, moving contacts pressed on such conductors and affixed to the car, a switch upon the car connected with such moving contacts, a branch circuit connected with the conductors beyond the movement of such contacts, a switch e^6 in said circuit, and a connection from the switch to each landing adapted to actuate the switch by the opening of the door at each landing to prevent the starting of the motor until the door is closed, substantially as set forth.

9. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a motor-circuit supplied with a current of constant strength, a car-switch located therein to control the movements of the hoisting mechanism, and a landing-switch located in such circuit and operating normally to complete said circuit and provided with additional

contacts adapted when opening the circuit to close a branch circuit and to thereby avoid an open circuit in any position of the said switch, as set forth.

10. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a motor-circuit supplied with a current of constant strength, a car-switch located therein to control the movements of the hoisting mechanism, and a landing-switch located in such circuit and operating normally to complete said circuit and operating when moved to close branch circuits for actuating the hoisting mechanism, as set forth.

11. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a motor-circuit supplied with a current of constant strength, a car-switch located therein to control the movements of the hoisting mechanism, and a landing-switch located in such circuit and operating normally to complete said circuit and operating when moved in opposite directions to close branch circuits through the motor-armature in opposite directions, as set forth.

12. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a motor-circuit supplied with a current of constant strength, a car-switch located therein to control the movements of the hoisting mechanism, and a series of landing-switches located in said circuit and provided with suitable contacts to normally close said circuit and to connect them in series and operating each when moved to close a branch circuit through the motor-armature, as set forth.

13. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a motor-circuit supplied with a current of constant strength, a car-switch located therein to control the movements of the hoisting mechanism, and a series of landing-switches located in said circuit and provided with suitable contacts to normally close said circuit and to connect them in series, and the said switches being provided with other contacts to close branch circuits in opposite directions through the motor-armature for actuating the hoisting mechanism, substantially as set forth.

14. In an electric-elevator system operated by an electric motor, the combination, with a hoistway provided with landings and landing-doors, of a door-lock having a bolt operating normally to secure the door, an electro-magnet for operating or retracting the door-bolt and having its coils in a branch of the motor-circuit, and a switch in such branch circuit operated by the car when at the landing, as and for the purpose set forth.

15. In an electric-elevator system, the combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a motor-circuit with a landing-switch located therein, an electrical indicator located at the landing, and a derived circuit connected with the same and adapted to operate the electrical indicator, as set forth, and an indicator-switch at the landing for opening and closing such indicator-circuit, substantially as described.

16. In an electric-elevator system, the combination, with a suspended car moving in a hoistway, hoisting mechanism operated by an electric motor, a landing provided with a landing-switch in the motor-circuit for regulating the motion of the motor, an electric indicator located at the landing, a circuit derived from the motor-armature and adapted to operate the electric indicator, as set forth, and an indicator-switch located in such circuit at the landing for opening and closing such derived circuit to operate the electric indicator, as and for the purpose set forth.

17. In an electric-elevator system, the combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a motor-circuit with a landing-switch located therein, an electrical indicator located at such landing and connected electrically with the commutator-brushes of the motor, and an indicator-switch at the landing for opening and closing such indicator-circuit, substantially as set forth.

18. In an electric-elevator system, the combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, electrical conductors fixed in the hoistway and connected with an electric generator and with the motor, moving contacts pressed on such conductors and affixed to the car, and a switch upon the car connected with such moving contacts and adapted to vary the current through the motor to vary its movements in the desired manner, substantially as set forth.

19. In an electric-elevator system, the combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, electrical conductors fixed in the hoistway and connected electrically with a generator and with the motor, moving contacts pressed on such conductors and affixed to the car, a switch upon the car connected with such moving contacts, and one or more of the conductors being interrupted with connections at each side of the break for a landing-switch, and a landing-switch operating normally to maintain the circuit through such broken conductor, as and for the purpose set forth.

20. In an electric-elevator system, the combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, four electrical conductors fixed in the hoistway, four moving contacts attached to the car and adapted to press on said conductors, two of the said conductors being connected electrically with the commutator-brushes of the motor and the other two being connected directly or indirectly with the positive and negative wires from the gen-

erator, and a switch upon the car connected with such contacts and adapted to reverse the current through the commutator, substantially as set forth.

21. In an electric-elevator system, the combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, four electrical conductors fixed in the hoistway, four moving contacts attached to the car and adapted to press on said conductors, two of the said conductors being connected electrically with the commutator-brushes of the motor, one with the end of the field-coils and the other with one end of the line-wire, and a switch upon the car connected with such contacts and adapted to connect each of the commutator-brushes alternately with the field-coils and with the said line-wire, substantially as set forth.

22. In an electric-elevator system, the combination, with a hoistway provided with one or more landings, of hoisting mechanism operated by an electric motor, four electrical conductors fixed in the hoistway, one or more of said conductors being broken at a landing, but adapted for the passage of a moving contact, four contacts upon the car pressed upon such conductors, a circuit connecting the motor with the car through certain of said conductors, a car-switch connected with said contacts and operating normally to close the circuit around the motor-armature, and a landing-switch operating to normally close the circuit around the break in the broken conductor and provided with additional contacts adapted when opening the circuit at the break to close a circuit through the other conductors and through the motor to operate the same, substantially as set forth

23. In an electric-elevator system, the combination, with a hoistway provided with a series of landings, of hoisting mechanism operated by an electric motor, four electrical conductors fixed in the hoistway, one or more of said conductors being broken at each landing, but adapted for the passage of a moving contact, four contacts upon the car pressed upon such conductors, a circuit connecting the motor with the car through certain of said conductors, a car-switch connected with said contacts and operating normally to close a circuit around the motor-armature, and a series of switches located at the landings and operating normally to close the circuit around the several breaks in the broken conductors and provided with additional contacts adapted to close branch circuits in opposite directions through the motor-armature, as and for the purpose set forth.

24. In an electric-elevator system, the combination, with a hoistway provided with a series of landings, of hoisting mechanism operated by an electric motor, four electrical conductors fixed in the hoistway, one or more of said conductors being broken at each landing, but adapted for the passage of a moving contact, four contacts upon the car pressed upon such conductors, a car-switch connected with said contacts and operating normally to close a circuit around the motor-armature, and a series of switches located at the landings and operating normally to close the circuit around the several breaks in the broken conductor or conductors, and the car-contact for the broken conductor being arranged to move from the break in opposite directions when the car moves from the landing up and down, so as to cut off the car-switch from the main circuit, except through the landing-switch connected around such break, substantially as set forth.

25. In an electric-elevator system operated by a constant current, the combination, with a suspended car moving in a hoistway having landings and landing-doors, of door-switches arranged and operated by the opening of the doors to short-circuit the motor and to thus stop the same until the door is closed, substantially as set forth.

26. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, an electric circuit for operating the motor, a car-switch located therein and operating normally to stop the said motor and when moved in opposite directions to close reverse circuits through the motor-armature, and a door-switch located in a branch of such circuit and operating, substantially as described, to stop the car when moved to such door with the car-switch shifted and adapted when the door is closed to complete the circuit through such shifted car-switch to start the car in the same direction, substantially as herein set forth.

27. In an electric-elevator system, the combination, with a suspended car moving in a hoistway provided with landings, of hoisting mechanism operated by an electric motor, electrical conductors fixed in a hoistway and connected with an electric generator and with the motor, moving contacts affixed to the car and pressed upon such conductors, a switch upon the car connected with such moving contacts, a break in one of the conductors beyond the movement of such contacts, a branch circuit connected with the broken conductor at the opposite sides of such break, and a door-switch held normally open in such branch circuit at each landing and closed by the opening of the door at such landing to prevent the starting of the motor until the door is closed, substantially as herein set forth.

28. In an electric-elevator system operated by a constant current, the combination, with a suspended car moving in a hoistway having landings and landing-doors, of door-switches actuated by the opening and closing of the doors to close and open a circuit between the main line on one side of the motor and the main line on the opposite side of the motor and thus operating to short-circuit the

motor when any of the said doors is open, substantially as set forth.

29. In an electric-elevator system, the combination, with a suspended car moving in a hoistway provided with landings, of hoisting mechanism operated by an electric motor, electrical conductors and a circuit connecting the motor with the car and with the said landings, and switches upon the car and upon the landings connected with said circuit and provided each with contacts and with a movable lever or connector adapted to reverse the motion of the car by reversing the motor and to stop the car by stopping the motor, substantially as herein set forth.

30. In an electric-elevator system in which the motion of an electric motor is transmitted to the car by means of a hoisting-pulley, intermediate mechanism, and a hoisting-rope, the combination, with a hoistway provided with landings, of a motor-circuit, a switch located upon the car, and one or more switches located upon the landings, all of the said switches being located in the motor-circuit and arranged and operated to reverse the motion of the car by reversing the motor and to stop the car by stopping the motor, substantially as herein set forth.

31. In an electric-elevator system in which the motion of an electric motor is transmitted to the car by means of a hoisting-rope, the combination, with such rope, of a hydraulic cylinder with piston and rod for actuating such rope, a reversible pump actuated by the electric motor for operating such hydraulic piston, a motor-circuit, and a car-switch located in said circuit and operating to reverse or to stop the motor and to thereby reverse and stop the hydraulic pump, as and for the purpose set forth.

32. In an electric-elevator system in which the motion of an electric motor is transmitted to the car by means of a hoisting-rope, the combination, with such rope, of a hydraulic cylinder with piston and rod for actuating such rope, a reversible pump actuated by the electric motor for operating such hydraulic piston, a hydraulic accumulator connected with the cylinder and operated to overbalance the weight of the car, a motor-circuit, and a car-switch located in said circuit and operating to reverse or to stop the motor and to thereby reverse and stop the hydraulic pump, as and for the purpose set forth.

33. The combination, with a stationary electric motor, hoisting mechanism actuated thereby, and a suspended car moved by such hoisting mechanism, of a primary circuit to actuate said motor, a motor-switch in such circuit provided with contacts to stop or reverse the motion of the motor, an electro-magnet with movable magnetic armature for moving the said switch, an independent electrical circuit connected with such electro-magnet, and one or more switches arranged in or near the path of the car in such independent circuit and provided with contacts to reverse the current through such electro-magnetic device and to thereby actuate the motor-switch, substantially as herein set forth.

34. In an electric-elevator system in which a car or platform hoisting device is operated by a stationary electric motor and the motor is stopped and started to stop and start the hoisting-mechanism, the combination, with the motor-circuit, of a magnetically-operated brake applied to the hoisting mechanism and having its magnet-coils in the motor-circuit, and a switch located in the said circuit and constructed and operated to close the circuit simultaneously through the motor and through the brake-magnet, as and for the purpose set forth.

35. In an electric-elevator system in which a car or platform hoisting device is operated by a stationary electric motor and the motor is stopped and started to stop and start the hoisting mechanism, the combination, with the motor-circuit, of a brake pressed normally upon the hoisting-pulley, an electro-magnet for withdrawing the brake and having its coils in the said motor-circuit, and a switch located in the said circuit and constructed and operated to remove the brake from the hoisting-pulley when starting the motor by simultaneously closing the circuit through the motor and the brake-magnet, substantially as herein set forth.

36. In an electric-elevator system, the combination, with a moving car and a hoistway provided with landings and landing-doors, of hoisting mechanism operated by an electric motor, a magnetically-operated brake applied to the hoisting mechanism, electrical conductors fixed in the hoistway, contacts pressing on such conductors and affixed to the car, a switch upon the car connected with such sliding contacts adapted to reverse the motor when desired, a circuit through the electric motor and the brake-magnet, and landing-switches connected with such circuit and connected also with the car-switch through the conductors and provided with contacts adapted to close the circuit through the car-switch, the motor, and the brake-magnet when the landing-switches are in their neutral position and the car-switch in operation, substantially as set forth.

37. In an electric-elevator system in which a car or platform hoisting device is operated by a stationary electric motor, the combination, with the electric motor and the car or platform moved thereby, of an operative electric circuit and a switch actuated by the movement of the car at the extreme opposite ends of its travel to stop the car at such points, substantially as herein set forth.

38. In an electric-elevator system in which a car or platform hoisting device is operated by a stationary electric motor, the combination, with the electric motor and the car or platform moved thereby, of an operative electric circuit, electrical conductors for conveying the current to and from the moving car, and a

switch upon the car connected with said conductors and provided with contacts to reverse the electric current and actuated by the movement of the car at the extreme opposite ends of its travel to stop the car at such points, substantially as herein set forth.

39. In an electric-elevator system, the combination, with the electric motor and with the conductors 1, 2, 3, and 4 connected thereto to shut off or reverse the current through the same, of the breaks 30 and 31 provided at the landings in the conductors 3 and 4, and landing-switches provided each with fixed contacts electrically connected with the conductor 3 above and below the break 30 with fixed contacts electrically connected with the conductor 4 above and below the break 31, a fixed contact connected with the conductor 2 and a fixed contact connected with the conductor 1, and four movable springs or contact-plates 26 27 28 29, the several contacts being arranged and operated when the four movable contacts are moved in one direction to connect the conductor 3 above the break 30 with the conductor 1, as shown at the lower switch in Fig. 7, and to cut off the current from conductor 3 below the break 30, and at the same time to connect the conductor 4 below the break 31 with the conductor 2 and to cut off the current in the conductor 4 above the break 31, and the stationary contacts being arranged when the four movable contacts are turned in the opposite direction to reverse the connections of the conductors 3 and 4 with the conductors 1 and 2 to reverse the current through the motor, and the movable contacts being adapted when in their intermediate position to connect the conductor 3 above the break 30 with the same conductor below the break and the conductor 4 above the break 31 with the same conductor below the break, as and for the purpose set forth.

40. In an electric-elevator system in which a car or platform hoisting device is operated by a stationary electric motor, the combination, with the electric motor and the car-platform moved thereby, of an electric circuit, electrical conductors for conveying the current in said circuit to and from the car, a switch upon the car connected with said conductors through contacts adapted when the switch is in its neutral position to stop the hoisting mechanism actuated by the motor, and a projection from the switch actuated at the ends of the hoistway by dogs adapted to throw the switch into its neutral position and to thereby automatically stop the car at the proper limits of its travel, substantially as herein set forth.

41. In an electric-elevator system, the combination, with a hoistway provided with landings and landing-doors, of a door-bolt projected normally through the door-frame into the door, a lever applied to such bolt and extended into the hoistway, and a projection upon the car adapted to operate upon such lever or extension to withdraw the bolt when the car is at the landing adjacent to such door, as and for the purpose set forth.

42. In an electric-elevator system in which the electric motor is connected in a circuit supplied with a regulated current derived from a central station for the distribution of power, as described, the combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, electrical conductors and a circuit connecting the motor with the car, and one or more switches located in such circuit and provided with a movable lever or connector and with contacts adapted to maintain the circuit, as required, when the connector is moved and to vary the course of the current in the motor to stop or start the same, as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM BAXTER, Jr.

Witnesses:
L. Lee,
Thos. S. Cram.

(No Model.) 5 Sheets—Sheet 1.

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SYSTEM OF OPERATING ELECTRIC ELEVATORS WITH LANDING SWITCHES ONLY.

No. 449,662. Patented Apr. 7, 1891.

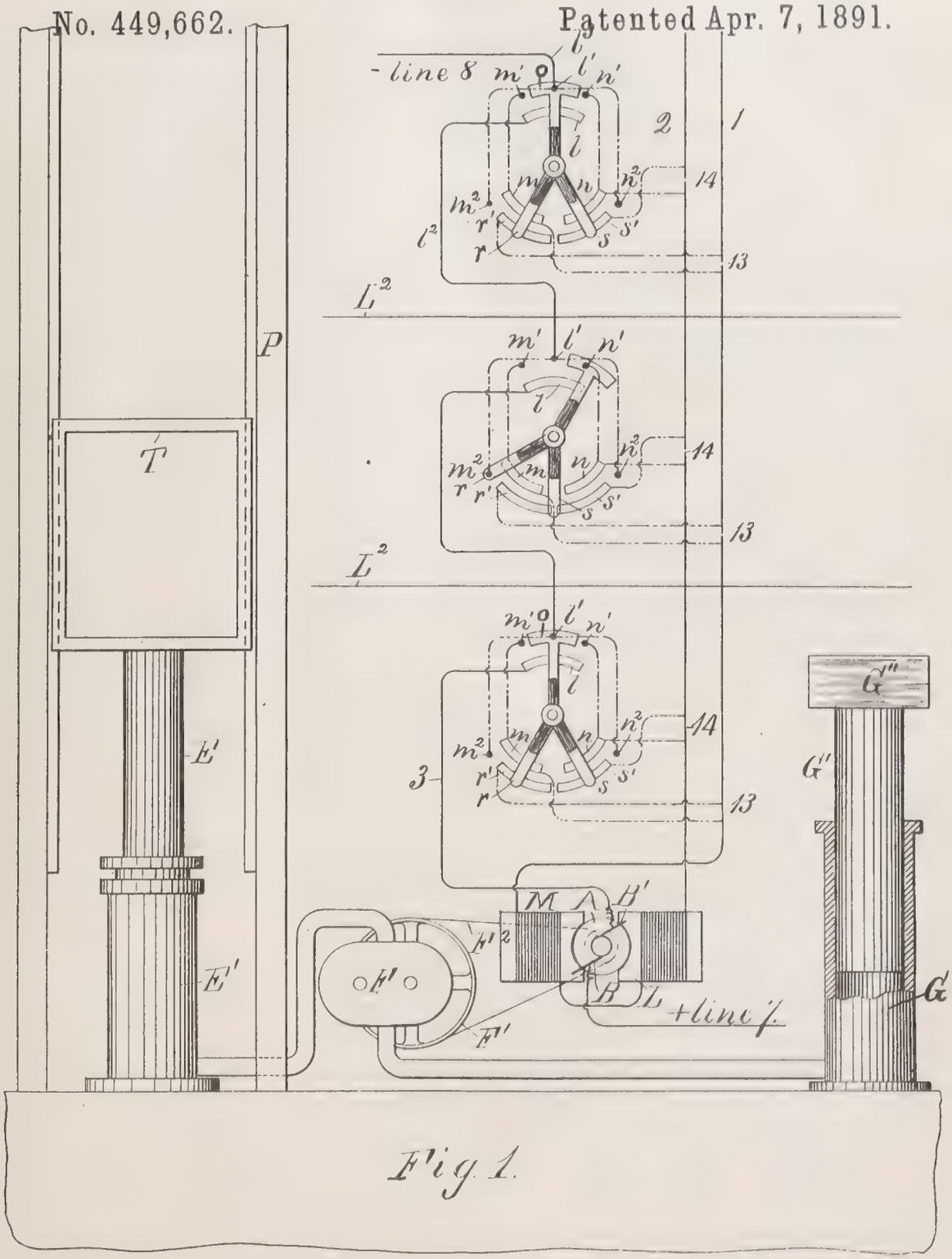

Fig. 1.

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(No Model.) 5 Sheets—Sheet 2.

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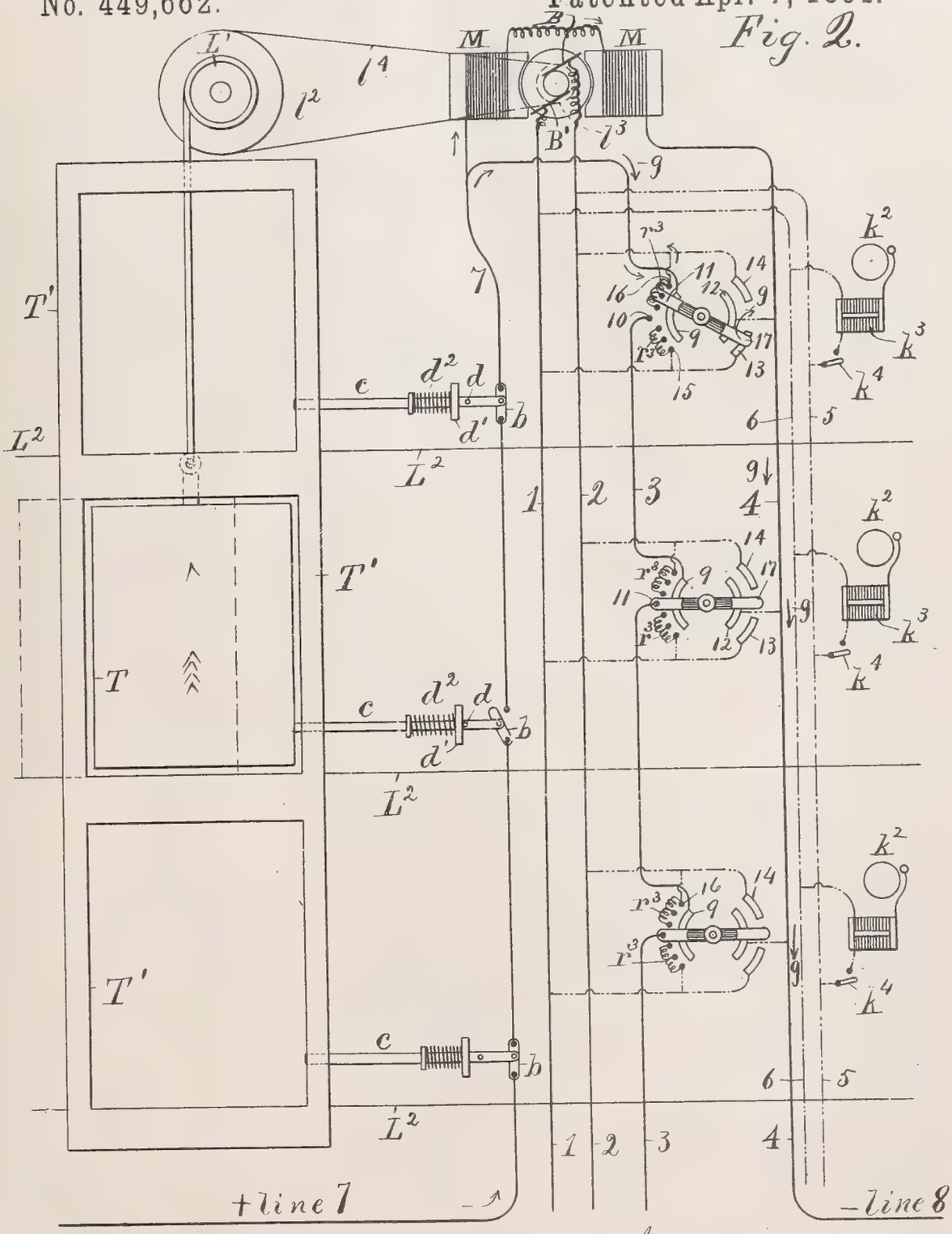
SYSTEM OF OPERATING ELECTRIC ELEVATORS WITH LANDING SWITCHES ONLY.

No. 449,662. Patented Apr. 7, 1891.

Fig. 2.



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(No Model.) 5 Sheets—Sheet 3.

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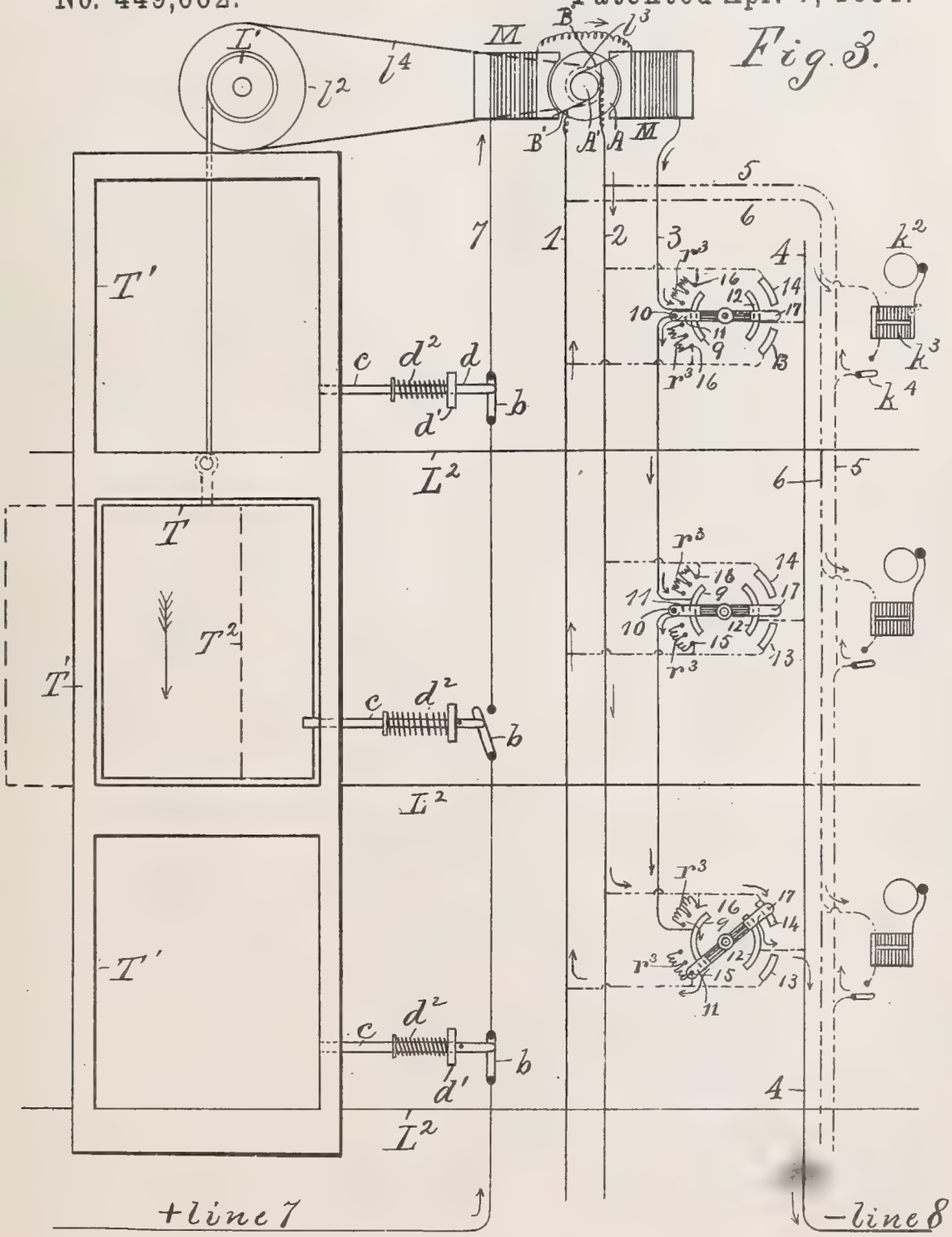
SYSTEM OF OPERATING ELECTRIC ELEVATORS WITH LANDING SWITCHES ONLY.

No. 449,662. Patented Apr. 7, 1891.

Fig. 3.



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SYSTEM OF OPERATING ELECTRIC ELEVATORS WITH LANDING SWITCHES ONLY.

No. 449,662. Patented Apr. 7, 1891.

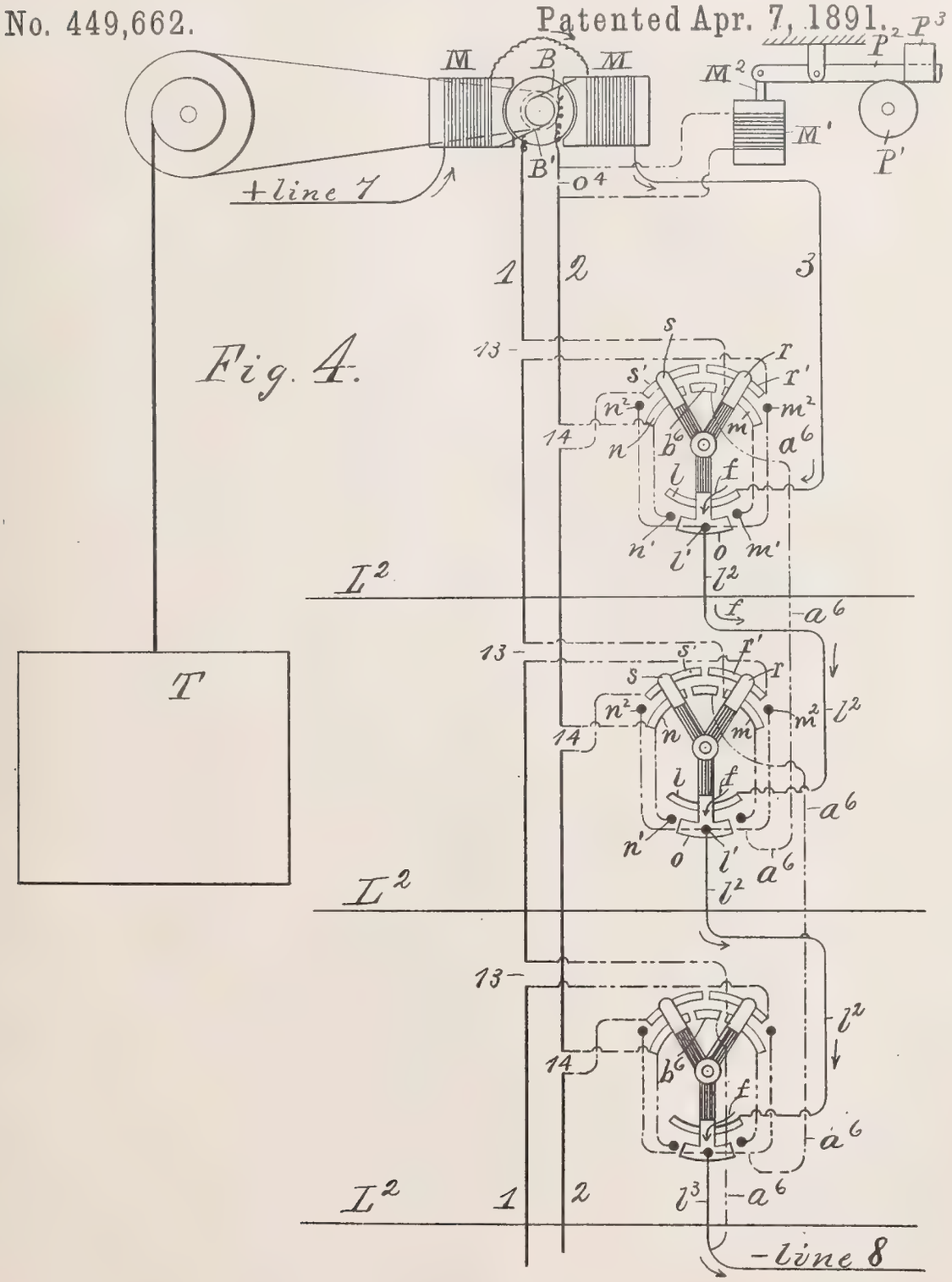

Fig. 4.

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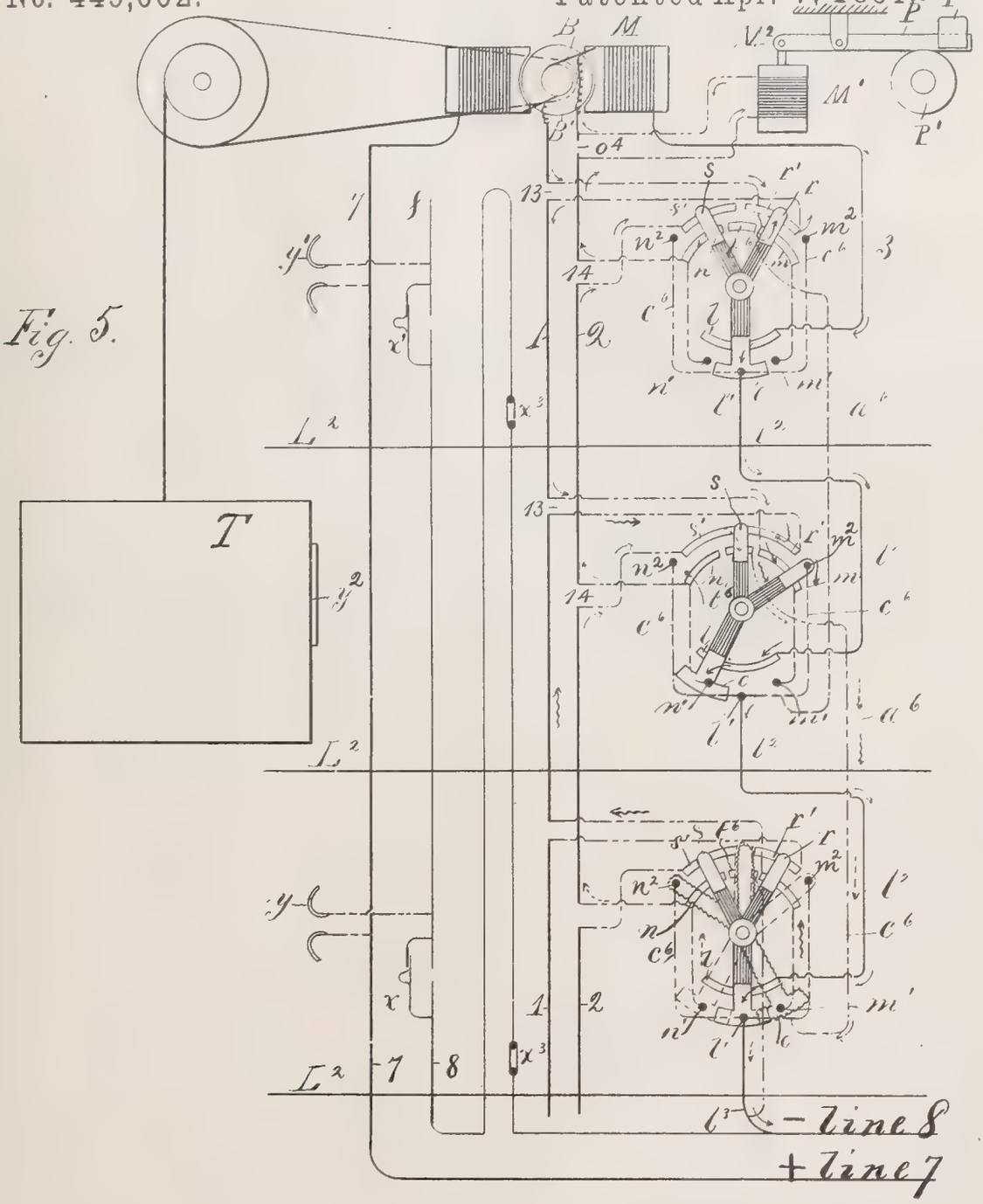
(No Model.) 5 Sheets—Sheet 5.

W. BAXTER, Jr.

SYSTEM OF OPERATING ELECTRIC ELEVATORS WITH LANDING SWITCHES ONLY.

No. 449,662. Patented Apr. 7, 1891.

Fig. 5.



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UNITED STATES PATENT OFFICE.

WILLIAM BAXTER, JR., OF BALTIMORE COUNTY, ASSIGNOR TO THE BAXTER ELECTRIC MOTOR COMPANY, OF BALTIMORE, MARYLAND.

SYSTEM OF OPERATING ELECTRIC ELEVATORS WITH LANDING-SWITCHES ONLY.

SPECIFICATION forming part of Letters Patent No. 449,662, dated April 7, 1891.

Application filed April 20, 1888. Renewed October 31, 1890. Serial No. 369,876. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM BAXTER, Jr., a citizen of the United States, residing in the ninth election district of the county of Baltimore and State of Maryland, have invented certain new and useful Improvements in a System of Operating Electric Elevators with Landing-Switches Only, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of this invention is to provide a means for controlling the movement of a platform or car arranged to move in a hoistway; and the invention consists in a system of electrical circuits and switches adapted by varying the course of the electric current in the circuits to vary the movement of the hoisting mechanism in the desired manner from the landings only.

The invention is particularly applicable to hoisting mechanism actuated by an electric motor.

In my patent application, Serial No. 267,524, filed March 17, 1888, I have made claim to a system of circuits and switches for regulating the hoisting mechanism from the moving car and for landing-switches operating in conjunction with a car-switch; but my present construction is restricted to the use of switches arranged at landings or fixed points only, and is thereby adapted to control the movements of a car or platform carrying no operator, as a dumb-waiter or a freight-hoisting platform. It is therefore provided with means for indicating to an operator at any one of the series of switches whether any other switch in the series has been turned from its normal position, the indicator showing if the car or platform is already in motion, and with automatic stop-switches for arresting the movement of the car at the limit of its travel.

Certain parts of my invention are also limited to the use of a regulated current generated by a dynamo-electric machine, the switches being formed with contacts that are joined during the movement of the switch-arm from one contact to another, so that the system may be used with a current of constant potential, or the switches being provided with a series of resistances that are cut out as the switch-lever closes the circuit through the electric apparatus and the system thus adapted to operate with a current of constant potential. By adapting the switches to operate with a regulated current my system for operating elevators may be placed in the circuits now largely used for the distribution of light and power, in which circuits the current is generated by a dynamo-electric machine at a central station, and the various electrical apparatus which are operated from such a central station are arranged in series in the circuit if the current be regulated to possess constant strength, or in multiple arc if the current be regulated to possess constant potential.

My invention will be understood by reference to the annexed drawings, in which—

Figure 1 is a diagram showing a car moved by a hydraulic hoister, the switches being adapted to a constant potential in the electric circuit. Fig. 2 is a diagram showing a car actuated by an electric motor with three switches adapted to operate with constant potential in the circuits and the switch nearest the motor turned to run the car up. Fig. 3 is a similar diagram with the lower switch turned to bring the car down. Fig. 4 is a diagram showing the car actuated by an electric motor and three switches adapted for constant current in the circuit; and Fig. 5 shows a diagram the same as Fig. 4, with certain of the switches turned to indicate their operation.

Where an electric motor is used to actuate the hoisting mechanism, the motor may be compound or shunt wound or wound in series or otherwise, and the variations effected in the circuit by the switches may be restricted to the armature-circuit or the field-circuit, if preferred.

In Fig. 1, showing a series-wound motor adapted to operate with constant potential in the circuit, the hoistway is indicated merely by two parallel beams P, with a car T arranged between them and actuated by a hydraulic plunger E, fitted to a hydraulic cylinder E'. The magnet-coils of an electric motor are indicated at M and the armature at A, and a

rotary pump F is shown connected by a pulley F′ and belt F^2 with a pulley L upon the shaft of the armature A. An accumulator G, provided with weighted plunger G′, is connected with the suction of the pump, and its outlet is connected with the bottom of the elevator-cylinder E′, so that the rotation of the motor and pump in one direction will draw the fluid from the accumulator and force it into the elevator-cylinder to hoist the car T, while the reversal of the motor and the consequent rotation of the pump in the opposite direction will withdraw the fluid from the hydraulic cylinder and restore it to the accumulator. The weight G″ upon the plunger G′ of the accumulator may serve to balance the piston of the elevator-cylinder E′ and the car with part of its load.

The commutator-brushes are shown at B B′, and wires or conductors 1 2 3 are shown arranged parallel with the hoistway and provided with connections to a series of switches arranged upon the different hoistway-landings L^2. It is obvious that such electrical wires may be carried to any location and the connections effected with the same facility; but their arrangement by the side of the hoistway is most convenient for illustrating the electrical connections and the operation of the circuits in the drawings.

The conductors 1 and 2 are connected, respectively, with the terminals of the field-coils, the conductor 3 with the commutator-brush B′, and the wire l^3, which is attached to the contact l' in the last switch of the series, with the — line-wire, while the + line-wire is connected with the other brush B. With such connections the current enters the armature-circuit at B and emerges at B′, and the switches operate to transmit the current from the conductor 3 or its connection l^2 into either the conductor 1 or 2 at pleasure, the opposite conductor 2 or 1 being simultaneously connected with the conductor l^3 and — line-wire 8 to complete the circuit to the generator. The switch-lever is formed with three arms, each having a spring adapted to press upon a contact-segment and upon other contacts adjacent thereto. The three springs are wholly insulated from one another upon the arms of the switch-lever and are lettered, respectively, *r*, which is normally in electrical connection with conductor 1; *s*, which is normally in electrical connection with conductor 2, and *o*, which is normally in electrical connection with conductor 3. Each spring thus serves to connect any contact to which it may be moved with its respective conductor.

Adjacent to the segment *l* in each switch is a contact *l′*, connected when the switch-lever is in its normal position with the segment *l* of the switch next in series, excepting that the contact *l′* in the last switch is connected with the — line 8 by means of the wire l^3. The conductors 1 and 2 are broken at each switch and provided with loops and with contacts which serve when the switches are in their normal position to close such conductor through all the switches

The conductor 1 is connected in each switch with contacts *m* and *m′* below the break 13 and with the contact *r′* above such break, and the conductor 2 is connected in each switch with contacts *n* and *n′* below the break 14 and with a contact *s′* above such break. The contacts *m* and *n* are adjacent to the contacts *r′* and *s′*, and are adapted to be connected therewith by the springs *r* and *s* of the switch-lever, and the contacts *m′* and *n′* are adjacent to the segment *l*, and are adapted like the contact *l′* to be connected therewith by the spring *o*. Contact-studs m^2 and n^2 are also arranged adjacent to the segments *r′* and *s′* and connected with the contact *l′*.

When the switch-levers are all in their normal position, the spring *r* serves to close the conductor 1 through all the segmental contacts *m* and *r′*, and the spring *s* operates to close the conductor 2 through all the segmental contacts *m* and *s′*.

The current when the motor is at rest and the switch-levers are all in their normal position, as shown in Fig. 4, passes through the field-coils and reaches the — line 8 by the wire 3, contacts *l* and *l′*, springs *o*, and wires l^2 and l^3.

In Fig. 1 the middle switch is shown turned to the right, and the current through the field-coils, which passes through the contacts *l* and *l′* in the first switch, enters the contact *l* in the second switch, and is directed by the shifted spring *o* into the contact *n′*, from which it passes by contact *n* to the conductor 2. The current then passes around the break 14 at the first switch through the spring *s* and enters the field-coils M by conductor 2. From the field-coils the current passes around the break 13 in conductor 1 through the spring *r* in the first switch, and is then led by the shifted spring *r* in the second switch from the contact m^2 to the contact *l′* in the same switch, whence it passes through the spring *o* in the switch beyond it and wire l^3 to the —line 8. The current in such case would rotate the armature and pump in a certain direction—as, for instance, to pump the water into the hydraulic cylinder E′.

The turning of any of the switches in the opposite direction—that is, to the left—operates to throw the current from conductor 3 into conductor 1, and the current then passes into the field-coils M in the opposite direction and from the field-coils M′ into the — line 8.

With the above construction it is obvious that the movement of the car may be readily controlled from any landing, the levers being turned to the right or left, as required, to cause the car to move up or down in the hoistway, and the operator may therefore move the car from any stationary position to his own landing by observing whether the car is above or below the same and turning the switch in the proper direction

As it is common to connect a number of electrical devices, as lamps or motors, or both, in series in a single circuit when the circuit is operated with constant current, it is necessary to avoid an open circuit in any of the switches, whether in their normal position or moved to the right or left. The contact-studs n^2 and m^2 are therefore placed sufficiently near to the segments r' and s' for the arms r and s to touch such studs before they are moved from the segments, and the contact spring or leaf o is made long enough to reach from the contact l' to either of the adjacent contacts before moving from such middle contact.

It will be found by an examination of the drawings that the switch nearest the motor or the one first receiving the current from the positive conductor would control the movements of the car, and the movement of any such switch would neutralize the operation of a switch at any other landing if turned at the same time.

An electrically-operated indicator may be placed by each switch to inform the operator in advance whether the car is in motion from the turning of some other switch, and thus warning him not to move the switch, as it would result in opening the circuit.

Indicator-bells k^2 are shown in Fig. 3, the magnet-coils k^3 being shown connected by a switch or push-button k^4 with circuit-wires 5 and 6. Such wires are electrically connected with the brushes B and B′ of the commutator, (through the conductors 1 and 2,) and, owing to the increase in the electro-motive force of the armature when in motion, a branch circuit of sufficient intensity to actuate the hammer of the indicator-bell is established in the wires 5 and 6 when any of the switches k^4 is closed and the armature rotating. The operation of the bell or of any magnetically-operated indicator in such branch circuit would therefore show to the operator that the motor was in operation and that it would be improper to turn the adjacent switch.

Figs. 2 and 3 show constructions in which the car is suspended from a drum L′ and the drum is actuated by a pulley l^2, connected with a pulley l^3 upon the motor-armature shaft by a belt l^4. The motor-coils are indicated at M M′, the armature at A, and the armature-shaft at A′, and the motor is represented as shunt wound, with the conductors 1 and 2 connected to the armature-brushes, the conductor 3 to a branch of the + line-wire 7, and the conductor 4 to the − line-wire 8. The shunt-circuit through the magnet-coils extends directly from the + line to the − line and is always closed. In this construction the resistance in the circuit when the motor is standing still is equal to that of the magnet-coils, which, being greater than that of the armature, is more wasteful in its relation to the electric current than the resistance of the armature when at rest, which is the only resistance in the circuit when the connections are arranged as shown in Fig. 1, although applicable only to constant current in the circuits. The circuit-connections to the motor shown in Fig. 1 are therefore best adapted for constant-current circuits in situations where the hoister is used but little, and the resistance when it is at rest is the chief expense for the electric current.

The motor in Fig. 2 is shown shunt wound and in Fig. 3 series wound with connections adapted for constant potential in the circuit, and the conductors connected with the brushes being figured 1 and 2, the + conductor receiving the current directly or indirectly from the + line-wire 7 being numbered 3, and the − conductor connected with the − line-wire 8 being numbered 4. Each switch is placed in a loop of the + conductor 3, the ends of such loop terminating in fixed contacts 9 and 10, and the switch-lever is formed with two arms, one of which, provided with contact plate or spring 11, is adapted normally, as shown in the two lower switches in Fig. 2 and the two upper switches in Fig. 3, to connect such contacts and close the circuit through the loop to lead the current to the succeeding switch of the series. A segment 12, like the contact 9, is connected with conductor 4, and segments 13 and 14, adjacent to the same, are connected with the conductors 1 and 2. Studs 15 and 16 are also arranged adjacent to the contact-segment 9 and are connected to the conductors 1 and 2, and additional contacts with intermediate resistances r^3 are arranged between the contact 10 and the contacts 15 and 16. The spring 11 when moved from the contact 10 in either direction throws the current from the segment 9 into the stud 15 or 16, the intermediate resistances and contacts serving to introduce the current by degrees into the motor through the conductor 1 or 2. A spring 17 upon the other switch-lever arm operates when the arm is moved to connect the conductor 4 through segment 12 with the conductor 1 or 2 through segment 13 or 14. The movement of the switch thus serves simultaneously, as shown by the arrows g in Figs. 2 and 3, to direct the current from the conductor 3 into one of the armature-brushes and to direct the current from the conductor connected with the other armature-brush into the conductor 4 and − line-wire by the intermediate contact 12. The upper switch in Fig. 2 directs the current into the brush B, and, supposing the rotation of the motor thus produced would operate to elevate the car T, then the turning of any of the switches in the opposite direction, as in Fig. 3, would serve to throw the current into the brush B′ and to reverse the motor to lower the car.

In Figs. 2 and 3 a door-frame T′ is shown at each landing, with the car T represented as a hollow box within the frame upon the middle landing, and the wires 5 and 6 for the indicator-circuit are shown at the right hand of the conductors 1, 2, 3, and 4. A door T^2 is

shown in Fig. 3 in dotted lines (in front of such car) partially opened, and the same door is assumed to be closed in the door-frames at the other two landings of the same figure. Switches *b* are inserted in the conductor 7 and are opened, each, when the landing-door is opened, by a push-rod *c*, extended from an arm of the switch through the door-frame T'. A stop-pin *d* is inserted in each push-rod adjacent to a bearing *d'*, and a spring d^2 operates to hold the stop normally against the bearing and to hold the switches normally closed. The closing of the door operates by moving the push-rod against the resistance of the spring d^2 to close the switch *b*, and such closed switches thus maintain when all the doors are closed the continuity of the conductor 7, and thus preserve the circuit unbroken. The opening of any door, as that shown in dotted lines T^2 at the middle landing in Figs. 2 and 3, permits the spring d^2 to act and the switch *b* to be turned, thus breaking the circuit and preventing the operation of the motor until the door be closed. Such a construction necessitates the closing of the door by the operator at any landing before the car can be started from such landing, the closed door thus giving warning to other parties that the car has been moved from such landing and that the door should not be again opened until the car is returned.

In the construction shown in Fig. 1 the turning of two switches at the same time would operate to break the circuit, as the current when more than one switch at a time is turned is unable to find a continuous connection to the conductor l^3. Such an open circuit would do no harm when a current of constant potential was used; but where a current of constant strength is used, as with the construction shown in Fig. 1, an open circuit would interfere with any other mechanism arranged in the same circuit, and such switch-connections could only be utilized by carefully using the indicators shown in Figs. 2 and 3. In Figs. 4 and 5, however, is shown a system in which the switches are provided each with an additional contact adapted to carry the current from the motor-circuit to the line 8 independently of the series connection extending between the series of switches when in their normal position. In these figures the motor is shown series wound and the circuit adapted for constant current, and a brake adapted to check the movements of the motor when the circuit through the same is broken is indicated in a brake-wheel P', which would in practice be connected with the hoisting devices. P^2 is a lever pressed normally upon the brake-wheel by a weight P^3. M' is a solenoid, with core M^2 attached to the lever P^2, and operating when the coils of the solenoid are energized to lift the weighted lever from the brake-wheel. The solenoid-coils are connected by suitable wires with the conductor 2, closing a circuit around a break o^4 in such conductor, and the brake-magnet is therefore energized whenever the current passes through the conductor in actuating the motor and hoisting mechanism. The stoppage of the motor by opening the armature-circuit operates automatically to destroy the attraction of the brake-magnet and permits the brake-lever to press upon the brake-wheel and hold the hoisting mechanism and car stationary, as desired.

In my application, Serial No. 267,524, I have shown a brake thus operated, and do not therefore claim the same generically herein, but have restricted my claim to the combination of such a brake with a series of landing-switches only. The switches in Figs. 4 and 5 operate, with the exception of the additional contact just referred to above, the same as the switches shown in Fig. 1, with the circuits adapted for constant current. The conductors 1 and 2 are connected with the commutator-brushes B B'. The line-wire 7 is connected with one terminal of the field-coils, and the current from the other terminal of the field-coils passes through conductor 3 to the segmental contact *l* in the switch nearest the motor. In Fig. 5 the switch-lever in the lowest switch—that is, the one farthest from the motor which connects the circuit, with the — line 8—is shown in full lines in its normal position, in dotted lines turned to the right like the middle switch, and in wavy lines turned to the left. As the last contact *l'* connects the circuit with the — line 8, it follows that when the lower switch is turned at the same time as any other switch in the series it cuts off the connection of the segment *l* with such contact, and the current reaching such segment in the lowest switch would not therefore reach the — line 8 without an additional connection. When the spring *o* in the lower switch is shifted, it connects the contact *l*, which receives the current from the upper switches, with one of the adjacent contacts *m'* or *n'*, which are united electrically with the segments *m* and *n*. These segments are connected, respectively, with the conductors 1 and 2, so that a current passing therefrom may traverse either of such conductors to the segment *r'* or *s'* in the switch above, and an auxiliary contact is provided near the adjacent ends of such segments to receive the current therefrom and conduct it to the wire l^3 when required. Such auxiliary contact b^6 is placed in each switch of the series between the segments *m* and *n*, so that when either of the springs *r* or *s* is turned to actuate the motor the other spring *s* or *r* falls upon the contact b^6 and simultaneously connects the same with the adjacent ends of the segments *r'* and *s'*, the spring being made wide enough to join such segments. The contact b^6 in each switch is connected by a wire a^6 with the contact *l'* in the switch below it, and the current entering such auxiliary contact is thus led to the wire l^3 and — line 8 independently of the spring in the lower switch-levers.

The current returned to one of the upper switches by the simultaneous shifting of a switch below it enters such upper switch from the conductor 1 or 2 at the segment r' or s', and passes thence through the spring s (if such spring be upon the contact b^6, as shown in the middle switch) to the auxiliary contact, and thus through the wire a^6 to the contact l' in the lowest switch, and thence to the — line-wire 8.

The direction of the current in the circuits, with the middle switch turned and the lower switch in its normal position, is shown by the arrows in full lines, and the dotted arrows and wavy arrows indicate, respectively, the course of the circuit to reach the — line 8 when the lower switch, in addition to the middle switch, is turned in the directions shown in dotted or wavy lines.

With switches of the construction just described it is obviously impossible to make an open circuit, and the system thus wholly prevents any derangement of other apparatus (as are lights or other motors) that may be connected in series with such switches and their motor-circuit. The operation of two switches at the same time would, however, not be able to actuate the car in two opposite directions; but the switch nearest the motor, or, rather, the one first receiving the positive current, would control the circuit through the motor, and would thus control the movements of the hoisting mechanism. This will be understood by inspection of Fig. 5, where it will be seen that the current coming from the first switch is conducted from the segments l and n in the second switch to the commutator-brushes and back again to the segment m in the second switch, from which it passes to the segment l in the last switch of the series before its course is abnormally deflected. After passing through the armature-brushes it is immaterial how the current reaches the — line 8, and the course of the current in its passage through the conductor 2 and auxiliary contact b^6 in the middle switch to the lower contact l' by the wire a^6 produces therefore no effect upon the control which the second switch has already exercised upon the direction of the current. It would obviously be unnecessary to furnish indicators adjacent to such switches to prevent the production of an open circuit by turning a switch improperly; but such indicators applied to the armature-circuit, as shown in Fig. 2, would show the operator that the car was already in motion by the turning of some other switch, and that it would be improper for him to turn a switch, as it might, if nearer to the motor or + conductor, interfere with the switch previously turned and reverse the movement of the car operated thereby.

If the lower or middle switch were turned to make the car go up and the upper switch were simultaneously turned to make it go down, the upper switch would obviously reverse the motion of the motor and car as it receives the current from the conductor 3 in advance of the other switches, and would control the direction of its movement through the motor, as above described, in reference to the operation of the second switch upon the third. The indicators may therefore be used with advantage in any construction, although they have no necessary connection with the safe working of the circuits.

In Fig. 5 is shown a device for automatically stopping the car at the extreme limits of its travel, by which the car when started would be prevented from striking the top or bottom of the hoistway and doing injury to the apparatus. Such device consists in switches y and y', consisting in contact-springs adapted to be electrically connected by a plate y^2 upon the car when the car reaches the desired limits of its travel. The springs in such switches are connected, respectively, with the + and — lines 7 and 8 outside of the motor and landing-switch circuits, and thus serve when connected by the plate upon the car to short-circuit the motor and cut off the current from the entire system of switches. The motor being thus stopped, the movement of the car would be arrested; but it could not with such construction be started again without breaking the short circuit to restore the current to the switch-circuits, which would be effected by opening spring-switches, which could be located at any convenient point for the use of the operator. Such switches would be normally closed, and may be located, as at x and x', adjacent to the switches y and y', or they may be formed, as the switches x^3, in a loop of the circuit extended to any point within convenient reach of an operator. In case such automatic stop-switches are used the landing-switch should be properly turned to start the car in the opposite direction before the short circuit is broken and the motor started.

In Fig. 1 herein the current is normally closed in the armature-circuit and its course is varied by the landing-switches in the circuit of the field-coils, whereas Figs. 4 and 5 show the reverse arrangement, the current being normally closed in the circuit of the field-coils and affected by the switches in the armature-coils only.

In Figs. 2 and 3, where a current of constant potential is employed, the current also passes without change of direction through the field-coils, but is reversed in the armature-circuit to produce the desired movements of the armature.

I am aware that a valve has been shifted by an electro-magnetic device for the purpose of opening ports for the passage of fluid under pressure to a hydraulic elevator-cylinder and connected with switches to reverse the operation of such device, but not in a regulated circuit with other electric apparatus. The switches heretofore used with such an electro-magnetic device have not therefore been adapted for a regulated current

having either constant strength or constant potential, and the "make and break" switches heretofore used for operating such valve-shifting device could not be used with a regulated current, as they would be certain to produce a short circuit, which is not admissible when a current of constant strength is employed.

My first claim herein is therefore restricted to the use of hoisting apparatus in circuit with other electrical devices in a system for the distribution of light or power in which a regulated current is employed and with which switches are required of different construction from those heretofore used for such a purpose.

I hereby disclaim the combination, with a valve in a hydraulic hoisting apparatus, of an electro-magnetic device connected with switches, the current being supplied merely by a galvanic battery.

I also disclaim my application, Serial No. 267,524, filed March 17, 1888, in which certain parts of my present invention are shown but not claimed, and in which I have made generic claim to certain features which are claimed specifically herein.

It is obvious that where the nature of the current be changed from constant current to constant potential in the circuits the switches would be changed in a corresponding manner to avoid a short circuit in the one case and an open circuit in the other.

It will be understood that when a current of constant potential is used and the circuit is closed through a revolving armature like that shown in the electric motor in Figs. 2 and 3 it is absolutely necessary to provide artificial resistances r^3 in the switches, because the resistance of the armature is very much less when standing still than when it is rotating, as it develops a counter electro-motive force in proportion to the speed of rotation. If the circuit were closed by the switch through the armature when stationary, the dynamo-electric machine with which the circuit is connected would develop so great a current as to destroy the insulation and electrical connections. By providing the resistances and connecting them with studs arranged in the path of the moving connector 11 the resistances are all included in the circuit when the current is first thrown into the armature, and may be gradually cut out as the speed of the armature and its electro-motive force increases.

It is obviously immaterial whether the electro-magnetic shifting device (to operate merely in producing a movement of some other part, as in Fig. 6) be constructed with an oscillating or rotating armature, as a rotating armature is well known at the present time as a means for producing motion by combination with suitable gearing or mechanism and would be a mere equivalent for the oscillating shifter shown in Fig. 6.

A variety of constructions for the switches has been shown herein; but it is obviously immaterial what form of switch be used, provided the contacts and connections are constructed and arranged to operate as herein set forth. I have, however, in each of the drawings marked the conductor 3, which is represented as transmitting the positive current to the switches, and in like manner the conductors are numbered 1 and 2, respectively, in which the course of the current is varied or reversed to actuate the electro-magnetic device in the desired manner.

The forms of the door-switches b (shown in Figs. 2 and 3) and the stop-switches y and y' (shown in Fig. 5) are wholly immaterial, provided the essential elements of the construction are employed. Thus the switches b and the switches x^3 (shown in Fig. 5) may be made of a mere spring pressed against a metallic contact, and the switches y and y' may be formed in a similar manner and the spring pressed upon its opposed contact to close the circuit by the operation of the plate y^2 upon the moving car. The plate y^2 in such case would operate to produce the contact, although not conveying the electricity from one conductor to the other.

It will be understood that the direction of the arrows shown upon the drawings to indicate the course of the currents are predicated upon the use of the line-wire 7 as a positive conductor; but it is evident that the electric current would find the same continuous connections if passed through the circuits in an opposite direction when the switches are in their operative position, and it is therefore wholly immaterial whether the current be traversed through the circuits in the manner shown in the drawings or in a reverse manner, which would be effected by using the positive line-wire as a negative conductor. In such latter case the motion of the motor would not thereby be reversed, as the magnetism of the field and armature would be similarly effected, and the attraction or repulsion of the parts would be precisely the same with the current operating in either direction.

Having thus set forth my invention, what I claim herein is—

1. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, an electric circuit connected normally through the armature of the motor, a series of landings, and a series of landing-switches located thereon and provided with contacts for controlling the course of the current in said circuit, as and for the purpose set forth.

2. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, an electric circuit connected normally through the armature of the motor, a series of landings and a series of landing-switches located thereon and provided with contacts connected with said circuit, the series of switches operating normally to stop the said motor and each switch

operating when moved in opposite directions to close reverse-circuits through the motor, as and for the purpose set forth.

3. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, an electric circuit connected normally through the armature of the motor with a current of constant potential, a series of landings, and a series of landing-switches located thereon and provided with contacts for varying the course of the current in said circuit, the series of switches operating normally to open the circuit through the motor, field-coils, and each switch operating when moved in opposite directions to close reverse-circuits through the motor, as and for the purpose set forth.

4. The combination, with a suspended car moving in a hoistway, of hoisting mechanism actuated by an electric motor, an electric circuit connected normally through the armature of the motor, and a series of landings with landing-switches located in said circuit, the switches being provided with suitable contacts to normally cut off the current from the motor, field-coils, and operating each when moved to close a circuit through the motor field-coils, as and for the purpose set forth.

5. The combination, with a suspended car moving in a hoistway, of hoisting mechanism actuated by an electric motor, an electric circuit connected normally through the armature of the motor, and a series of landings with landing-switches located in said circuit, the switches being provided with suitable contacts to normally cut off the current from the motor field-coils, and operating each when moved in opposite directions to close branch circuits in reverse directions through the motor field-coils, as and for the purpose set forth.

6. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a primary circuit closed through the armature, a branch circuit between one of the commutator-brushes and one terminal of the field-coils and a branch circuit between the other brush and the other terminal of the field-coils, a series of landings, and a series of landing-switches having contacts connected with both of such branch circuits and operating normally to cut off the current from the field-circuit and adapted to reverse the current through the field-coils, as and for the purpose set forth.

7. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a primary circuit-conductor connected with one of the motor-brushes, a series of landings, and a series of landing-switches provided with contacts connected, respectively, with the other armature-brush, the terminals of the field, and with the other primary conductor, the switches being normally connected in series and operating normally to cut off the current from the field-circuit and when moved in opposite directions to reverse the current through such field-circuit, as and for the purpose set forth.

8. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a primary circuit-conductor connected with one of the motor-brushes, a series of landings, and a series of landing-switches provided with contacts connected, respectively, with the other armature-brush, the terminals of the field, and with the other primary conductor, the switches being normally connected in series and operating when thus connected to cut off the current from the motor-field and when moved in opposite directions to reverse the current through such field-circuit, as and for the purpose set forth.

9. In an electric-elevator system, the combination, with a suspended car moving in a hoistway having landings and landing-doors, of hoisting mechanism operated by an electric motor, an electric circuit for operating the motor, and a door-switch arranged in said circuit and operated by the opening of the door to cut off the current from the motor, and to thus stop the same until the door is closed, as and for the purpose set forth.

10. In an electric-elevator system, the combination, with a suspended car moving in a hoistway having landings and landing-doors, of hoisting mechanism operated by an electric motor, an electric circuit for operating the motor, and one or more door-switches arranged and operated by the opening of the door or doors to open the motor-circuit and to thus stop the motor until the door or doors are closed, as and for the purpose set forth.

11. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, an electric circuit for operating the motor, landing-switches located upon the landings of the hoistway and connected with said circuit, and a series of door-switches located in branches of such circuit and operated, substantially as described, to stop the car by the opening of any of the said doors, as and for the purpose set forth.

12. In an electric-elevator system in which the motion of an electric motor is transmitted to the car by means of a hoisting-pulley, intermediate mechanism, and a hoisting-rope, the combination, with the motor-circuit, of a brake actuated by an electro-magnet circuit, a brake actuated by an electro-magnet for retarding the hoisting mechanism, and a series of landings and a series of landing-switches connected with the said motor-circuit and provided each with contacts adapted to close the circuit through the brake-magnet, as and for the purpose set forth.

13. In an electric-elevator system in which a car or platform hoisting device is operated by an electric motor, the combination, with the electric motor and the car-platform

moved thereby, of an operative electric circuit, stop-switches connected with such circuit and arranged at the top and bottom of such hoistway and provided with contacts adapted when connected to cut off the current from the motor, and a contact-plate upon the car arranged and operated to connect such contacts when contiguous to either of said switches to close the said circuit and cut off the current from the motor, as and for the purpose set forth.

14. In an electric-elevator system in which a car or platform hoisting device is operated by an electric motor, the combination, with the electric motor and the car-platform moved thereby, of an operative electric circuit, stop-switches connected with such circuit and arranged at the top and bottom of such hoistway and provided with contacts adapted when connected to cut off the current from the motor, a contact-plate upon the car to connect the contacts in either of said switches, and an auxiliary switch to temporarily open said circuit when closed by either of the stop-switches, substantially as herein set forth.

15. The combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, an electric circuit for operating the motor, landing-switches located upon the landings of the hoistway and connected with said circuit, and stop-switches arranged at the top and bottom of the hoistway and provided with contacts connected, respectively, with the prime conductors outside of the motor and landing-switch circuits, and a contact-plate upon the car adapted to electrically connect the contacts in either of said switches when contiguous thereto, substantially as herein set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM BAXTER, JR.

Witnesses:
W. F. D. CRANE,
THOS. S. CRANE.

(No Model.)

J. McADAMS.

CONTROLLING DEVICE FOR ELEVATORS.

No. 460,675. Patented Oct. 6, 1891.

Fig. 1.

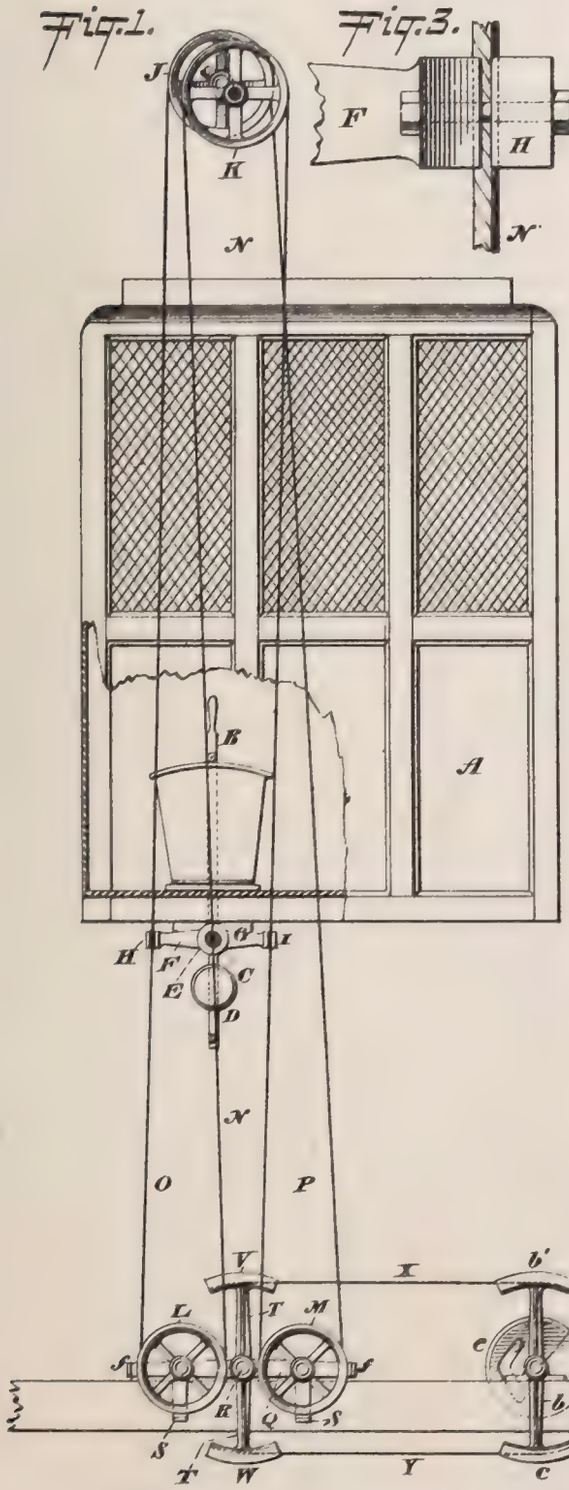


Fig. 3.

Fig. 4.

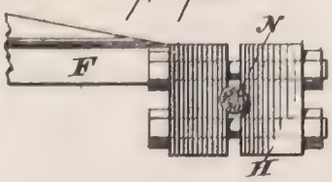


Fig. 2.

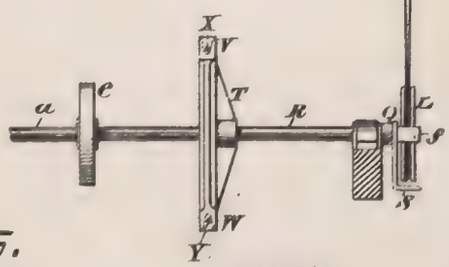
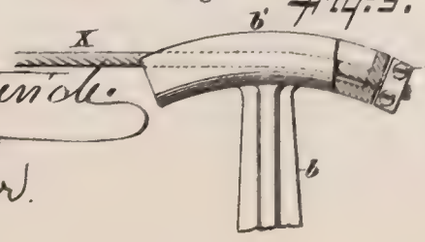


Fig. 5.



WITNESSES:

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Ed. D. Miller.

INVENTOR

John McAdams,

BY

Chas. B. Gill

ATTORNEY.

THE HORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN McADAMS, OF NEW YORK, N. Y.

CONTROLLING DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 460,675, dated October 6, 1891.

Application filed May 13, 1891. Serial No. 392,573. (No model.)

To all whom it may concern:

Be it known that I, JOHN McADAMS, a subject of Her Majesty the Queen of Great Britain, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Hydraulic Elevators, of which the following is a specification.

The invention relates to improvements in hydraulic elevators; and it consists in the novel means hereinafter described and claimed, whereby the attendant in the carriage may conveniently and with reliability operate the pilot-valve, which admits water to the main valve of the hydraulic engine.

Referring to the accompanying drawings, Figure 1 is a side elevation, partly broken away, of an elevator-carriage with connecting mechanism constructed and arranged in accordance with the invention made the subject of this application. Fig. 2 is a like view of same, but looking at another face of the elevator-carriage. Fig. 3 is a detached elevation of one of the clamps for connection with the operating-cable. Fig. 4 is a detached top view of same; and Fig. 5 is a detached side elevation, partly in section, of a segment forming one of the details of the mechanism constituting the invention.

In the drawings, A designates the cab or carriage, provided at a suitable point with the lever B, which is normally vertical and adapted to be moved on its axis to either side of its vertical center. The lever B is secured on the rock-shaft C, which is mounted in bearings fastened to the lower surface of the carriage A, and said lever is provided with the counter-balance D, suspended below the carriage.

Upon the end of the rock-shaft C opposite to the lever B is mounted the frame E, consisting of the transverse arms F G, having upon their ends the clamps H I for positive attachment to the continuous cable N, passing over the pulleys J K at the top of the elevator-shaft, and the pulleys L M at the base of said shaft.

The cable N, while continuous, is divided practically into two sections, (lettered O P, respectively,) the former passing over the pulley L and thence upward to the pulleys J K, while the section P passes over the pulley M, and thence extends upward to the pulleys J K. The section O of the cable N is firmly secured to the arm F by means of the clamp H, and the section P is likewise secured to the arm G by means of the clamp I, and hence with the rocking of the shaft C through the working of the lever B the sections O P of the cable will be affected, as hereinafter described.

The pulleys L M are mounted upon the ends of the horizontal frame Q, secured upon the end of the rock-shaft R and having the arms S, whose lower extremities are in close proximity to the pulleys L M and prevent the cable N from slipping from said pulleys. The extremities of the frame Q also form fingers *f f*, which aid in preventing the cable from slipping from the pulleys L M. The frame Q is rigid on the shaft R, and upon said shaft there is also rigidly mounted the vertical frame T, provided at its upper and lower ends with the segments V W, which are grooved to receive the cables X Y, the latter at one end resting in said grooved segments and being there secured by means of clamps, such as the one lettered Z in Fig. 5. Adjacent to the shaft R there is suitably mounted in bearings the rock-shaft *a*, carrying the frame *b*, corresponding with the frame T, above described, and provided with the grooved segments *b c*, in which the other end of said cables X Y are secured. The cables X Y thus extend from the segments V W to the segments *b' c*, and may be kept taut by means of clamps Z.

Upon the shaft *a* there is also mounted the cam-wheel *e* or other medium for imparting motion from the shaft *a* to the pilot-valve, (not shown,) by which water is admitted to the main valve of the hydraulic engine; and it is the purpose of the invention to produce adequate means between the lever B in the carriage and the shaft *a* whereby, through the medium of the cam *e* or other instrumentality, the attendant in the carriage may have full control of the said pilot-valve.

In the operation of the invention it may be understood that the carriage A will be at rest when the lever B is in its normal or vertical position, and that when said lever B is turned

to the right (referring to Fig. 1) the carriage will be ascending, while when said lever is turned to the left the carriage will be descending, and when said lever is again returned to its normal position the carriage will come to a stop. When the lever B is turned to the right, the frame E will move with it, the arm F thereof moving upward and the arm G downward, the effect of this movement being that the arm F will draw the section of the cable N to which it is attached upward and the arm G will draw the section of said cable to which it is attached downward, thereby tilting the frame Q at an angle corresponding with that of the arms F G and turning the shaft R and frame T a definite distance toward the shaft *a*. The turning of the shaft R and frame T toward the shaft *a* operates, through the cables X Y and frame *b*, to rotate the shaft *a* a distance corresponding with the rotation of the shaft R, and thereby to move the cam *e* for the purpose of actuating the pilot-valve. (Not shown.) It will thus be seen that when the lever B is turned to the right its movement will be communicated to the shaft *a* and cam *e*, and that thereby the pilot-valve will be moved a definite distance corresponding with the movement of the lever B. When it is desired that the elevator-carriage will travel in the opposite direction, the lever B will be moved to the left, (see Fig. 1,) whereby the arm F, with its section of the cable N, will be depressed and the arm G, with its section of the cable N, elevated, thereby rotating, through the frame Q, the shaft R in a direction opposite to that in which it was before moved when the lever B was turned to the right. The rotation of the shaft R under the action of the lever B when turned to the left operates, through the frame T, frame *b*, and cables X Y, to cause the shaft *a* and cam *e* to have a movement in the same direction as and corresponding with the shaft R. Thus the cam *e*, when the lever B is turned to the left, will have a movement opposite to that imparted to it when said lever B was turned to the right, and the effect will be to actuate the pilot-valve, (not shown,) and thereby control the flow of the water and the operation of the main valve of the hydraulic engine.

It will be understood from the foregoing description that when the lever B is in the position illustrated in Fig. 1 the elevator-carriage will be at rest; that when said lever is moved to the right the cam *e* will be actuated and will operate the pilot-valve to permit the movement of the carriage A in one direction, and that when said lever B is moved to the left the cam *e* and pilot-valve will be actuated to permit the movement of the elevator-carriage in the opposite direction. The pilot-valve is thus placed under the control of the attendant in the carriage and its operation is both convenient and reliable.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The lever to be operated by the attendant in the elevator-carriage, combined with the frame E, the continuous cable N, secured to said frame and passing over pulleys at the upper and lower ends of the elevator-shaft, the frame Q, carrying said pulleys at the lower end of the elevator-shaft and mounted upon a rock-shaft, the frame T, mounted upon said shaft, the rock-shaft *a*, carrying the frame *b* and connected with the frame T, and mechanism for imparting the motion of the shaft *a* to the pilot-valve, substantially as set forth.

2. The continuous cable N and the lever in the carriage connected therewith, said cable passing over pulleys J K at the top of the elevator-shaft, combined with the tilting frame Q, the pulleys L M, carried by said frame and receiving the cable N, the tilting frame T, connections X Y, tilting frame *b*, and mechanism, substantially as described, intermediate the frame *b* and the pilot-valve, substantially as set forth.

3. The pulleys J K at the top of the elevator-shaft, the frame Q, mounted on a rock-shaft at the base of said elevator-shaft, the pulleys L M, mounted on the opposite arms of said frame, and mechanism for communicating the motion of said frame to the pilot-valve, combined with the tilting frame E, carried by the carriage, and the continuous cable N, composed of sections O P, connected, respectively, with the opposite arms of said frame E, the section O passing over the pulley L and to both pulleys J K and the section P passing over the pulley M and to both pulleys J K, substantially as and for the purposes set forth.

4. The rock-shafts R *a*, the frames T *b* on said shafts, the segments on the ends of said frames, and the cables X Y, connecting said segments, combined with the frame Q on the shaft R, the pulleys L M on said frame Q, the cable N, the frame E, connected with said cable, and means for operating the frame E from the elevator-carriage, substantially as set forth.

Signed at New York, in the county of New York and State of New York, this 9th day of May, A. D. 1891.

JOHN McADAMS.

Witnesses:
CHAS. C. GILL,
ED. D. MILLER.

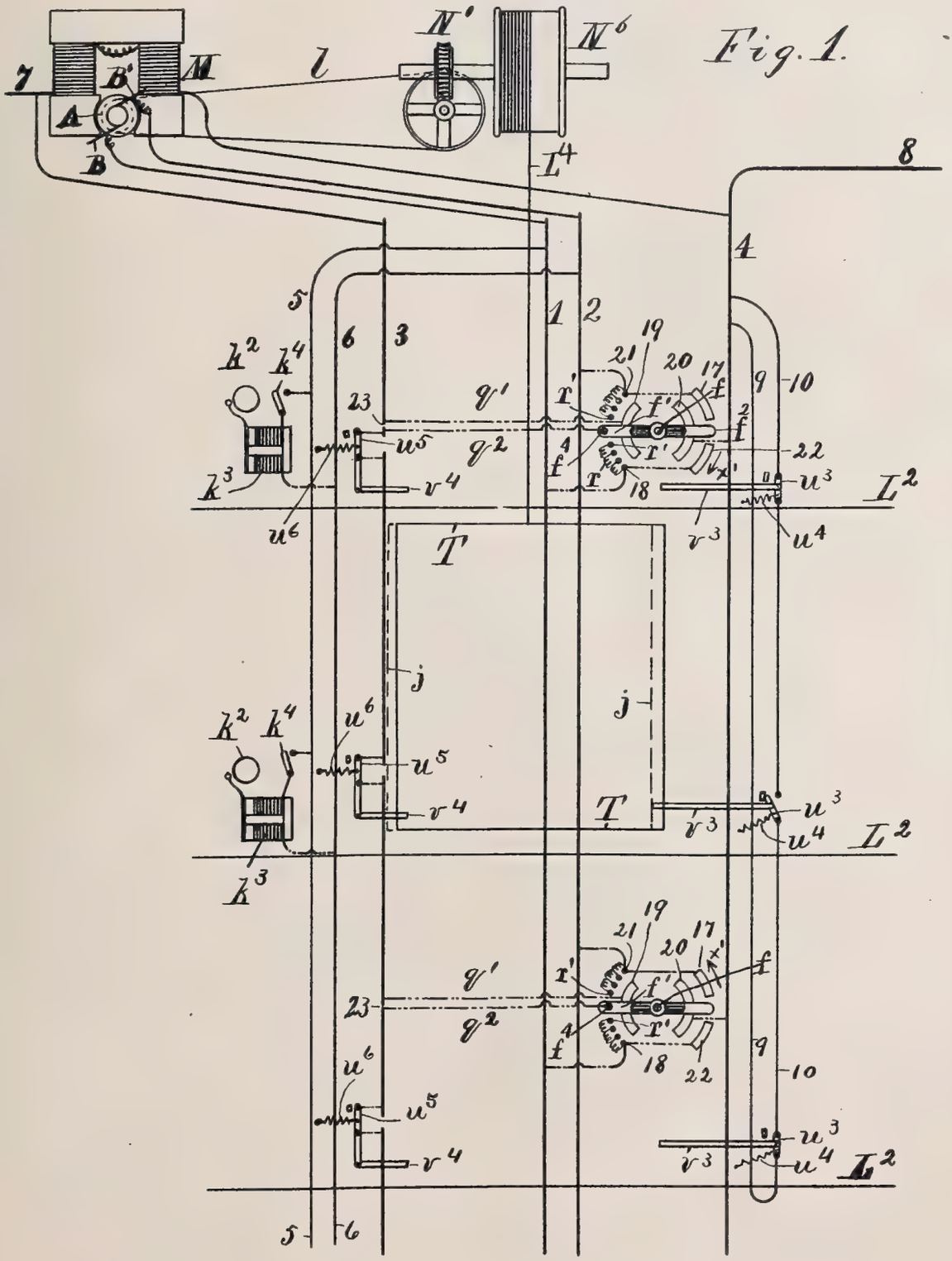
(No Model.) 4 Sheets—Sheet 1.

W. BAXTER, Jr.

ELECTRIC ELEVATOR.

No. 466,973. Patented Jan. 12, 1892.

Fig. 1.



Attest:
L. Lee.
F. C. Fischer

Inventor.
W. Baxter, Jr.,
per Crane & Miller, Attys.

(No Model.)

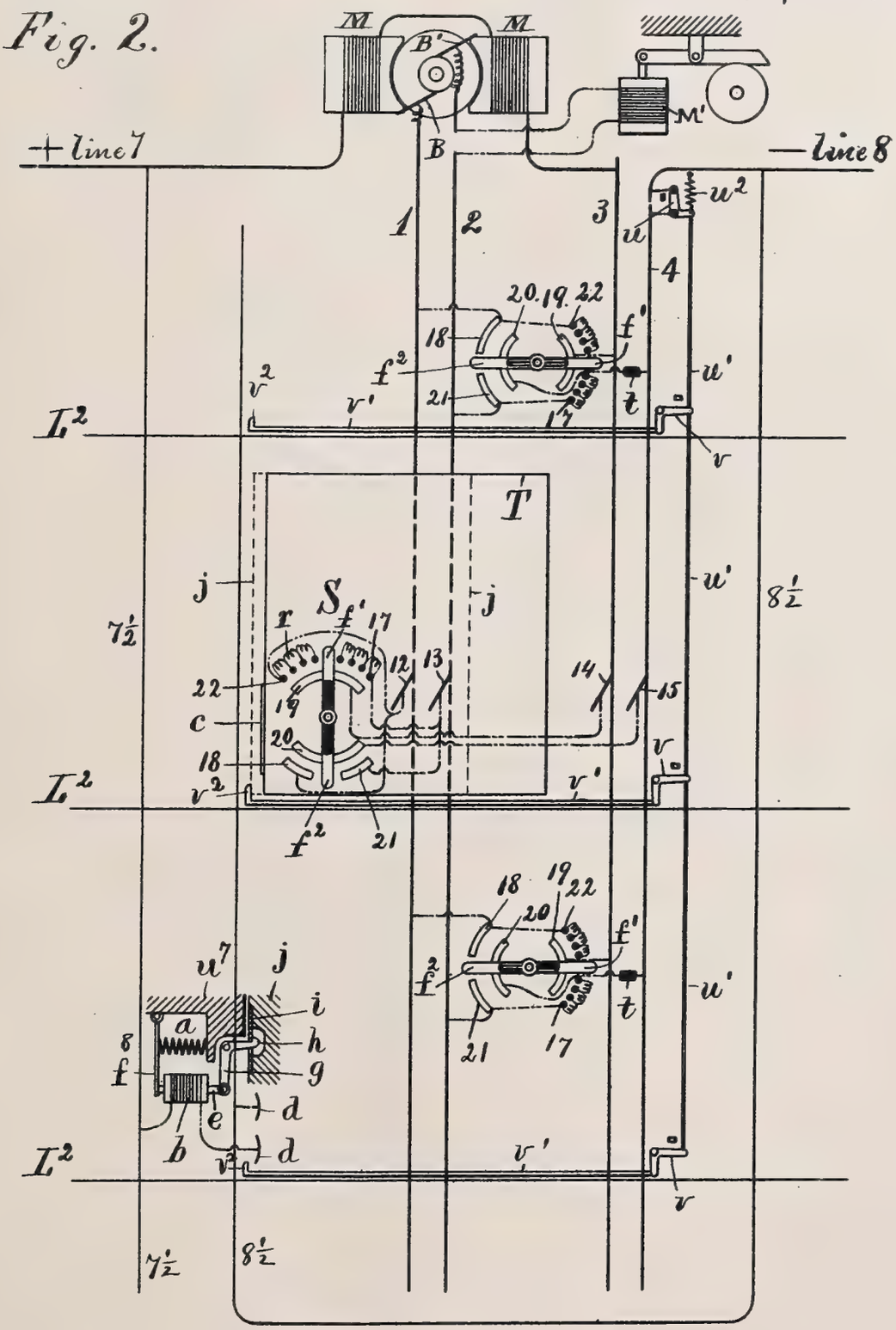
4 Sheets—Sheet 2.

W. BAXTER, Jr.

ELECTRIC ELEVATOR.

No. 466,973. Patented Jan. 12, 1892.

Fig. 2.



Attest:
L. Lee.
F. C. Fischer.

Inventor.
W. Baxter, Jr.,
per Crane & Miller, attys.

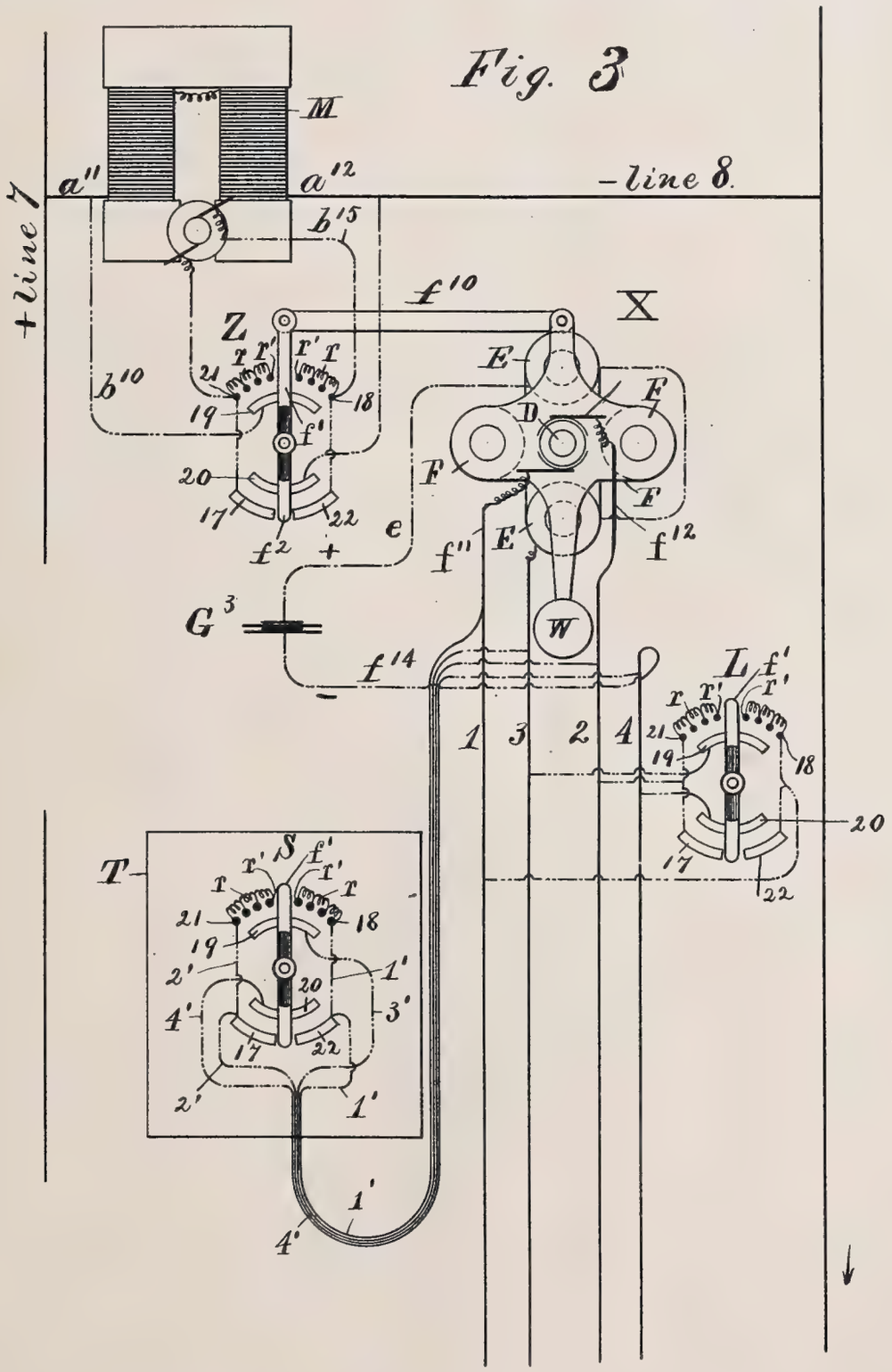
(No Model.) 4 Sheets—Sheet 3.

W. BAXTER, Jr.

ELECTRIC ELEVATOR.

No. 466,973. Patented Jan. 12, 1892.

Fig. 3



Attest:
L. Lee.
F. C. Fischer.

Inventor.
W. Baxter, Jr., per
Crane & Miller, attys.

(No Model.) 4 Sheets—Sheet 4

W. BAXTER, Jr.

ELECTRIC ELEVATOR.

No. 466,973. Patented Jan. 12, 1892.

Fig. 4

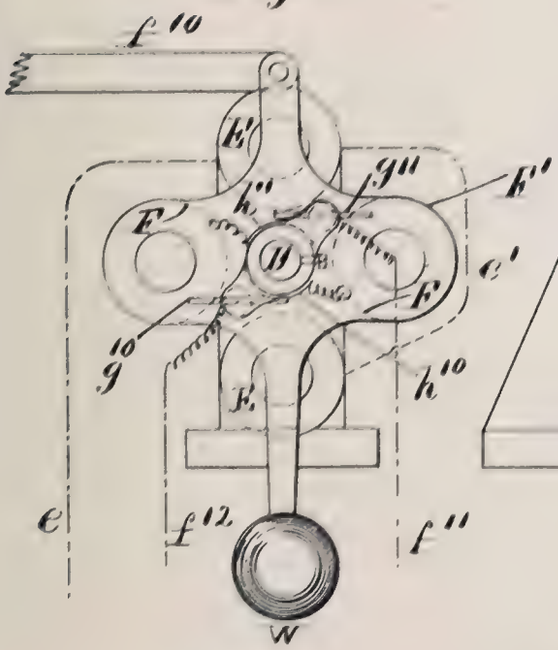
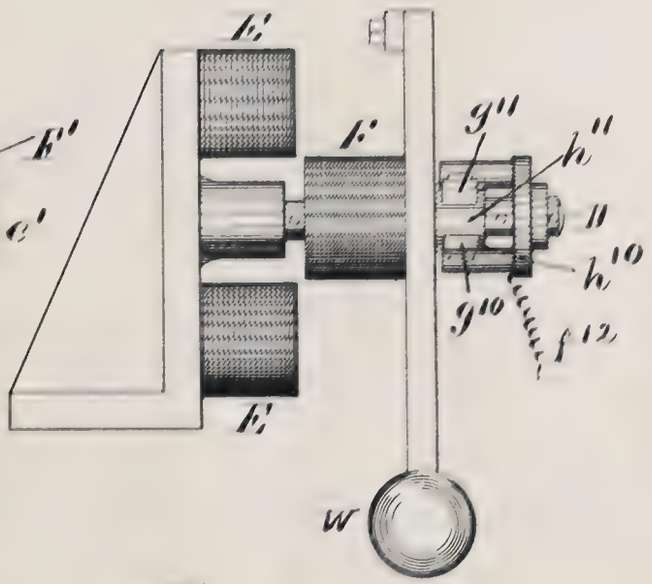


Fig. 5



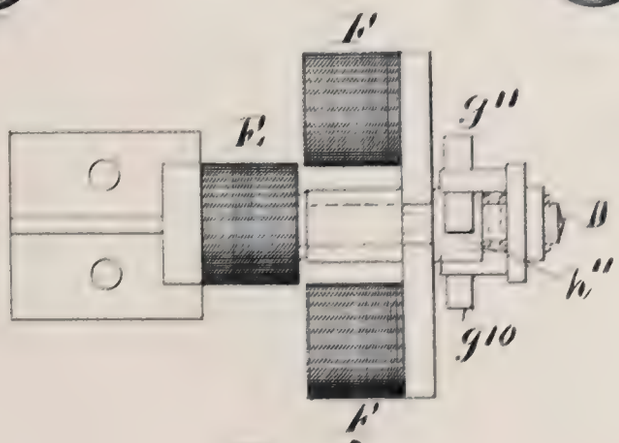


Fig. 6.

Attest:
Jo. Lose.
F. C. Fischer.

Inventor.
W. Baxter, Jr., per
Crane & Miller, Attys.

UNITED STATES PATENT OFFICE.

WILLIAM BAXTER, JR., OF BALTIMORE, MARYLAND, ASSIGNOR TO THE BAXTER ELECTRIC MOTOR COMPANY, OF SAME PLACE.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 466,973, dated January 12, 1892.

Application filed September 3, 1888. Serial No. 284,397. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM BAXTER, Jr., a citizen of the United States, residing in the city of Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Systems of Operating Electric Elevators with Constant-Potential Motors, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The present invention relates partly to means of electrically actuating the switch of an electric motor, partly to the construction and arrangement of switches for operating electric hoisters with a current of constant potential, and partly to special apparatus for locking the landing-doors of a hoistway. The constant-potential circuits referred to herein would be furnished by a dynamo-electric machine constructed or regulated to furnish such a current, and it would therefore be wholly inadmissible to permit a short circuit in any part of the system, as such short circuit would induce a current of abnormal strength in the "dynamo," and result in great injury thereto by the destruction of its insulation or its connections. In such a system it is therefore absolutely necessary when directing the current through a revolving armature or other structure in which a counter electro-motive force may be induced to provide the switches with resistances which may be gradually cut out of the circuit as such electro-motive force increases. By the use of such resistances a short circuit is prevented and the entire construction is adapted for operation with a circuit used to distribute power from a central station.

Figure 1 of the drawings shows an electric motor connected with a worm hoisting apparatus by means of a belt and pulleys and the car suspended by a rope from a hoisting-drum, the circuits being adapted for landing-switches only. In Fig. 2 I have omitted the hoisting mechanism and shown only a diagram of the motor with circuits provided with landing-switches and with a car-switch having sliding contacts applied to fixed conductors on the hoistway. Fig. 3 shows a circuit and generator independent of the motor-circuit for actuating an electro-magnetic shifting device to shift a switch in the motor-circuit, the car-switch and landing-switch being included in such independent circuit. Fig. 4 is a front view, upon a larger scale, of the switch-shifter X in Fig. 3. Figs. 5 and 6 are respectively a side view and a plan of the shifter upon the same scale as Fig. 4.

In Fig. 1, M is the motor, and N^6 the hoisting-drum, connected therewith by suitable worm-gearing N′ and pulleys provided with a belt *l*.

A car T is suspended from the drum by a rope l^4, and the stoppage of the motor operates to stop the drum and car, while its motion in opposite directions operates to elevate or lower the car, as desired.

B and B′ are the brushes applied to the motor-commutator, and the motor is shown shunt-wound, the positive conductor 7 furnishing a part of the current to the field-coils and the remainder passing through the switch-circuits to the brush B or B′ at the pleasure of the operator. The hoistway is omitted to expose the electrical connections, and the conductors 1, 2, 3, and 4 are shown arranged along the path of the car, the conductors 1 and 2 being connected with the brushes B and B′, the conductor 3 with the positive line-wire 7, and the conductor 4 with the negative line-wire 8. The circuits are shown in the figure connected with landing-switches only, and provided with segmental contacts 19 and 20, connected, respectively, with the conductors 3 and 4, adjacent to which contacts are arranged others connected, respectively, with the conductors 1 and 2. Adjacent to the segment 19, which receives the current from the conductor 3, are shown contact-studs r', having intermediate resistances *r*, the last stud 21 in one of the series being connected with the conductor 2, as is also a contact 17, adjacent to the segment 20. The last stud 18 in the opposite series of resistance-contacts is connected with the conductor 1, as is the contact 22, near the end of segment 20, opposite the contact 17. A circuit-controller for electrically joining the segments with the adjacent studs is shown formed as a lever pivoted between the segments upon a stud *f* and provided at one end with a metallic leaf or spring *f′*, adapted to connect the segment 19 with its adjacent contacts, and at the opposite end with a spring f^2 for connecting the segment 20 with its adjacent contacts 17 and 22. The springs are insulated from each

other. When the right-hand end f^2 of the circuit-controller is turned to the right, as indicated by the arrow upon the upper switch in the figure, the segment 19 becomes electrically connected by the leaf f' with the contact 21 and diverts the current from the conductor 3 into the brush B'. The leaf or spring f^2 at the same time connects the segment 20 with the contact 22, thus joining the conductors 1 and 4 electrically, and thus furnishing a course for the current from the brush B to the line-wire 8. The circuit-controller when turned to the left, as indicated by the arrow upon the lower switch in the figure, connects the segment 19, which receives the current from conductor 3, with the brush B, (through the stud 18 and conductor 1,) and at the same time connects the segment 20, which is joined to the negative conductor 8, with the brush B' by contact 17 and conductor 2. It will be noticed that the conductor 3 is formed with openings or breaks 23, which are normally closed by connections q' and q^2, which are united, respectively, to the segment 19 and to a stud f^4 opposite the middle of the same in each switch. The spring f' is shown in the figure in its middle or normal position, and then serves to connect the segment 19 with the middle contact f^4, so as to maintain the circuit unbroken through the conductor 3 when each switch lever or connector is in its normal position. The switch farthest from the motor may thus receive the current from the conductor 3 and regulate the movements of the current in the circuits so long as the other switch-levers are unmoved. The movements of the spring f' in any switch operates, however, to disconnect the stud f^4 from the adjacent segment 19, and thus breaks the continuity of the conductor 3 beyond such switch, so that when the car is moving under the control of any particular switch the movement of one farther from the armature will not affect it. If the motor or other electro-magnetic hoister-shifting apparatus were at the lower end of the hoistway and were connected with the lower ends of the conductors 1, 2, 3, and 4, it is obvious that the lower switch of the series would be nearest the electro-magnet and would control its operation. To advise the operator at any landing, except that nearest the electro-magnet, if the switch nearest the magnet is turned, indicators may be located at such landings and connected with a circuit derived from the motor-armature, as claimed in my patent, No. 449,611, issued March 31, 1891. Such indicators are shown in Fig. 1 as bells k^2, affected by bell-magnets k^3, the coils of which are electrically connected with the brushes B' by the conductors 5 and 6, when a switch k^4 connected with each indicator is closed. The armature A, when in motion, sets up a counter electro-motive force to actuate the indicators. The indicator-switches k^4 would be held normally open and closed by the operator only when desiring to learn whether the motor was already in operation before actuating the landing-switch, the ringing of the bell then showing if the motor was in motion. In Fig. 2 the same kind of landing-switches are used, except that the conductors are shown continuous and the stud f^4 is omitted from the switch. The motor is shown series-wound and having the terminal of the field-coils (which are connected with the + line 7) united to the conductor 3, which is joined to the segment 19, as in Fig. 1. Three landings L^2 are shown in the figure, with landing-switches upon the upper and lower landings, and a car (represented by a rectangle) at the middle landing and provided with a car-switch S, similar to the landing-switches.

Sliding contacts 12, 13, 14, and 15 are shown applied, respectively, to the conductors 1, 2, 3, and 4 and connected with the same contacts in the car-switch as their respective conductors are connected with in the landing-switches. The segments 19 and 20 in each of the switches are connected, respectively, with the primary conductors 7 and 8 through the conductors 3 and 4, which are connected therewith, and the other contacts in each switch permit the lever or connector to close circuits through the motor or other electro-magnetic apparatus. The switches are therefore, by virtue of the contact-segments 19 and 20, arranged in multiple arc between the primary conductors, as is common in arranging a series of connections to be operated by a current of constant potential.

With such construction as that shown in Fig. 2, the switch nearest the electro magnet would control its operation, as its circuit-controller would close a circuit for the current and would cut off the circuit from the more remote switches. Should a landing-switch be turned in the same direction as the car-switch, it would connect the same conductors; but if a car-switch were turned in one direction to connect the conductors 3 and 1 while the landing-switch was turned to connect conductors 1 and 4 a short circuit would be made and serious injury would be done to the dynamo generating the current for the motor-circuit. To prevent such short circuit, fusible plugs t may be inserted in the connections between the landing-switches and the conductor 4, or at any other suitable point. In a system adapted for constant current door-switches may be used to form, when actuated by the opening of the door, a short circuit, and thus prevent the motor from being started until the door is closed. In any construction with constant potential a short circuit is inadmissible and the door-switches may be arranged to open the circuit, as is shown in Figs. 1 and 2.

In Fig. 2 a single switch u is shown (in its closed position) inserted in the conductor 4 and connected by a link u' with bell-cranks v at each of the landings. A rod v' is shown at each landing extended beneath the door,

which is indicated by dotted lines *j* at the middle landing. The door at each landing, when closed, presses upon a hook c^2 at the end of the rod c' and operates in opposition to a spring u^3 (which holds the switch normally open) to hold the switch *u* closed. The landing-door is shown only at the middle landing, where the car T is represented, but would operate the same upon the hook c^2 at each of the other landings, being opened by a movement to the right, which would release the hook v^2 and permit the spring u^2 to open the switch *u* and thus open a circuit until the door were again closed. In Fig. 1 the conductor 4 is shown broken at the same point as in Fig. 2; but instead of placing a single switch at such break and operating the same by mechanical connections to the different landings, a branch circuit or loop formed by the wires 9 and 10 is extended to each of the landings, and at each a separate switch u^3 is inserted therein. Each switch would be held normally open, like the switch *u*, by a spring u^4 when the door was open, the switch being provided with a rod v^3, against which the edge of the door would push to close the switch when the door was shut. The door shown by the dotted lines *j* is shown only at the middle landing, where the car T is placed, and the door is shown partially opened by a movement to the left, so that the switch u^3 at such landing is opened and the circuit through the wires 9 and 10 is therefore broken.

Instead of extending a loop of the circuit to each landing, a break may be made at each landing in one of the conductors, as conductor 3 in Fig. 1, and a switch be applied to each break to maintain the continuity of the conductor when the landing-door is shut. The switches in such conductor are lettered u^5 and provided with springs u^6, which would serve to automatically open the switch when the door was moved away from the end of the push-rod v^4, and the circuit be thus held open until the door was closed.

The switches u^5 are all shown closed in Fig. 1, as it would only confuse the drawings to show a landing-door in position to open one of the same. A door-lock is shown in Fig. 2 adapted to be operated by a solenoid magnet *b*, connected with wires $7\frac{1}{2}$ and $8\frac{1}{2}$ in a branch circuit from the line-wires 7 and 8 by means of spring-contacts *d* and a plate *c* upon the side of the car T. To avoid obscuring the drawings, only a portion of the door-frame u^7 is shown, having a bolt with a hooked head *h* fitted therein and provided with an arm *g*, attached to the core *e* of the magnet *b*. A spring *a* is attached at opposite ends to the door-frame and to a lever f^8 and presses the lever normally upon the rear end of the core *e* to force it outward to cause the hooked bolt-head *h* to engage a plate *i* upon the edge of the door *j*. The attraction of the solenoid magnet *b* operates when the current in its coils is closed to draw the core *e* within the magnet and thus unlocks the door. The hooked form of the bolt-head enables it to engage the door automatically when the door is being closed, and the spring *a* then serves to hold the door-bolt in its locked position until the car in its movement to such door-landing brings the plate *c* into contact with the springs *d* and closes the main circuit through the magnet-coil *b*. The door may then be opened, so long as the car remains at the landing; but when it moves away from the same the branch circuit through the door-lock magnet is again broken and the bolt held in its locked position by the spring *a*. An electro-magnetic shifter may be used to actuate a switch in the motor-circuit, and such electro-magnetic shifter may be operated by a current derived from the motor-circuit, or an independent generator may be used to operate such shifter and the hand-switches inserted in such independent circuit. Such construction is shown in Fig. 3, the car-switch being connected with the conductors by a cable, and the independent generator G^3 being connected with the switch upon the car and with a landing-switch in the circuits of the electro-magnetic shifter. M is the magnet of the motor, which is shown shunt-wound and connected with a circuit and motor-switch Z, adapted to a constant-potential system. The switches in this figure are all similar to those heretofore described, and the current is shunted through the motor field-coils from the + line-wire 7 by wires a^{11} and a^{12}, and through the motor-switch Z by wires b^{10} and b^{15}, which are connected with the contacts 19 and 18 in such switch. The circuit-controlling levers f' f^2 in such switch are shown connected by the link f^{10} with a moving armature or electro-magnet. (Designated by the letter X.)

As shown in the enlarged views in Figs. 4, 5, and 6, the field-coils E of the electro-magnetic device are held stationary upon a suitable frame, with a stud D projected between the two magnet-coils E to support a movable bridge F', carrying two cores having coils F. A weight W is attached to the bridge to hold the coils F normally equidistant from the coils E. Insulated segments h^{10} and h^{11} are shown fixed upon a hub attached to the bridge F', and stationary brushes g^{10} and g^{11} are carried by a holder upon the stud D, The segments are connected with the two coils F and the brushes are connected by the wires f^{11} and f^{12}, respectively, with the conductors 1 and 2. The conductors are thus kept in electrical connection with the coils F when the bridge is oscillated back and forth by the magnetic attraction. The car-switch S and the landing-switch L are, like the switches shown in the other figures, provided with a series of studs adjacent to the segment 19, which is connected with the positive conductor 3, and intermediate resistances *r* are provided between the studs, so that when the leaf *f'* is first moved from its normal position the current must pass through the resistances *r* before entering the stud 18 or 21. When the circuit in the

switch L or S is closed with all the resistances in the circuit, the current of the independent generator that passes to the stud 18 or 21 is very weak and the magnetic movement of the shifting device X is correspondingly slight and the movement of the oscillating bridge F′ is correspondingly small. The link f^{10} therefore operates to shift the circuit-controller in the switch Z but a small amount and operates to close the circuit in the motor-switch with the same resistances that are included in the independent circuit. As the connector in the switch S or L is moved nearer such stud 18 or 21 and the resistances are gradually cut out, the current increases in the independent circuit, and likewise the magnetic moment of the shifting device X and the arc through which the bridge F′ moves is correspondingly increased.

It is evident that by a proper adjustment of the resistances in the motor-circuit and the independent circuit the movement of the electro-magnetic device X and of the connector in the motor-switch Z can be perfectly controlled.

From the above description it will be seen that the switches and circuits may operate upon an electro-magnetic device independent of the motor, as in Fig. 3, to regulate the application of the power to and its removal from the hoisting apparatus, or the electro-magnetic device which applies the power to and removes it from the hoisting mechanism may consist in an electric motor, in which case the circuits and switches operate to vary the course of the current in the motor itself.

I am aware that a valve has been shifted by an electro-magnetic device for the purpose of opening ports for the passage of fluid under pressure to a hydraulic cylinder; but I am not aware that any electro-magnetic device has ever been placed in a circuit derived from a dynamo-electric machine, such as is commonly used at the present time for the distribution of electric light and power. Such circuits are commonly supplied with a current from a central station, and the conductors for such circuit are represented in the attached drawings by the line-wires "+ line 7" and "− line 8."

When an electro-magnetic shifting apparatus is placed in such a circuit, the circuit would be furnished with either a current of constant strength or constant potential, and none of the "make-and-break" switches heretofore used in connection with a magnetic shifting apparatus could be used in such case, as a short circuit is not admissible when a current of constant potential is employed, and an open circuit is not admissible when a current of constant strength is used.

The electro-magnetic shifting devices heretofore used have been constructed with merely a flat vibrating armature moved to and from the end of the magnet-pole. My invention differs from such constructions in employing an oscillating armature rotated laterally toward the poles of an electro-magnet, by which construction the attractive force of the magnetic poles is more effectively employed.

It is obvious that a single flat armature cannot be advantageously moved through a considerable arc by a single attraction of the magnet-poles, owing to the great reduction in the magnetic attraction as the armature recedes from the poles, and a series of armatures fitted together upon the same shaft and arranged to be attracted successively by a series of magnets have therefore been used to secure a considerable angular movement in an electro-magnetic shifting device, as in United States Letters Patent No. 316,780, dated April 26, 1887.

By my construction the armature is not only located and operated more favorably in the magnetic field, but an electro-magnetic armature is, when desired, opposed to electro-magnetic poles, and coils are applied to the armature as well as to the magnet poles or cores, and circuit connections are provided with switch-contacts to reverse the current in such coils and to thus simultaneously alter the polarity of both the armature and magnet.

I hereby disclaim any construction in which a flat armature is vibrated at right angles to the surface of the magnet-poles and limit this part of my invention to an oscillating armature movable (upon a pivot) tangential to or parallel with the surface of the magnet-pole, so that the movement of the armature is not limited by contact with or approximation to the surface of such poles.

I have made no specific claim herein to the combination, with an elevator-car and its landings and an electric motor and mechanism connecting the motor to the elevator-car, of electrical switches on said landings, an electric switch in the elevator-car, and a line-circuit and connections for all of said switches and for the motor, as I have claimed the same in my patent, No. 449,611, issued March 31, 1891, in the prosecution of the application for which patent the said combination was made the issue of an interference in which priority was awarded to me; nor have I made any claim herein to operating an electric elevator by landing-switches only, as I have claimed the same in my patent, No. 449,602, issued April 7, 1891.

What I claim herein, and desire to secure by Letters Patent, is—

1. In an electric-elevator system, the combination, with an electric motor and hoisting mechanism operated thereby and provided with a hoisting-rope, of a car suspended by such rope in a hoistway, a motor-circuit supplied with a current of constant potential, a switch upon the car with contacts in said circuit, and a circuit-controller operating normally to open said circuit and operating with the contacts when moved to close the circuit through the motor to actuate the hoisting mechanism.

2. In an electric-elevator system, the com-

bination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a motor-circuit supplied with a current of constant potential, and a series of switches having contacts arranged in multiple arc in said circuit, and circuit-controllers in such switches operating, when moved from their normal position, to close the circuit through the motor to actuate the hoisting mechanism, as set forth.

3. In an electric-elevator system, the combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, continuous electrical conductors fixed in the hoistway and connected with an electric generator and with the motor, moving contacts affixed to the car, and a switch upon the car having separate contacts connected with said moving contacts, and a circuit-controller in the switch operating normally to open said circuit and operating, when moved in opposite directions, to close the circuit through the motor in reverse directions, substantially as set forth.

4. In an electric-elevator system, the combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a door-bolt held normally engaged, an electro-magnet adapted, when energized, to retract the door-bolt and release the door, a motor-circuit, a branch circuit connected with the coils of said magnet, contacts adapted to close such branch circuit when connected, and a metallic plate upon the car adapted to touch such contacts when the car is moved to the landing and to thus connect the said contacts and close the circuit through the coils of the magnet to unlock the door, substantially as herein set forth.

5. In an electric-elevator system, the combination, with a suspended car moving in a hoistway provided with landings, of hoisting mechanism operated by an electric motor, electrical conductors fixed in the hoistway and connected with an electric generator and with the motor, moving contacts affixed to the car and pressed upon such conductors, a switch upon the car connected with such moving contacts, a break in one of the conductors beyond the movement of such contacts, a switch to close the break, and a connection from the said switch to each landing adapted to actuate the said switch by the opening of the door at each landing to break the conductor and thus prevent the starting of the motor until the door is closed and the switch restored to its normal position, substantially as set forth.

6. In an electric-elevator system, the combination, with a suspended car moving in a hoistway provided with landings, of hoisting mechanism operated by an electric motor, electrical conductors fixed in the hoistway and connected with an electric generator and with the motor, moving contacts affixed to the car and pressed upon such conductors, a switch upon the car connected with such moving contacts, a break in one of the conductors beyond the movement of such contacts, a branch circuit connected with the conductors at the opposite sides of such break, and a door-switch held normally open in such branch circuit at each landing and closed by the closing of the door at such landing to prevent the starting of the motor until the door is closed, substantially as set forth.

7. In an electric-elevator system, the combination, with a suspended car moving in a hoistway having landings, of hoisting mechanism operated by an electric motor, an electric circuit supplied with a current of constant potential, switches upon the landings, and a switch upon the car, certain contacts in all the said switches being connected with the circuit in multiple arc and each switch being provided with a circuit-controller operating normally to open said circuit and operating with the contacts when moved to close the circuit through the motor to actuate the hoisting mechanism, substantially as set forth.

8. In an electric-elevator system for a series-wound motor to operate with a current of constant potential, substantially as herein set forth, the combination, with an electric motor, of four continuous conductors fixed along the hoistway, a car provided with sliding contacts for such conductors, connections from two of said conductors to the motor-commutator brushes, a connection from one terminal of the field-coils to a third or field conductor, a connection from the main-circuit wire to the fourth or line conductor, and a switch having suitable contacts connected with the four conductors, with resistance-contacts in the connections to the brush-conductors, the switch being arranged and operated to connect the brush-conductors alternately with the field and line conductors to reverse the motion of the motor when desired, substantially as herein set forth.

9. In an electric-elevator system, the combination, with a suspended car moving in a hoistway, of hoisting mechanism operated by an electric motor, a motor-circuit supplied with a current of constant potential, a switch arranged upon the car and switches upon the landings with contacts in said circuit, certain contacts in all the said switches being connected with the circuit in multiple arc, and each switch being provided with a circuit-controller operating normally to open said circuit and operating, when moved, to close the circuit through the motor to actuate the hoisting mechanism, and fusible plugs being inserted in an electrical conductor between the switches, as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WM. BAXTER, JR.

Witnesses:
L. LEE,
THOS. S. CRANE.

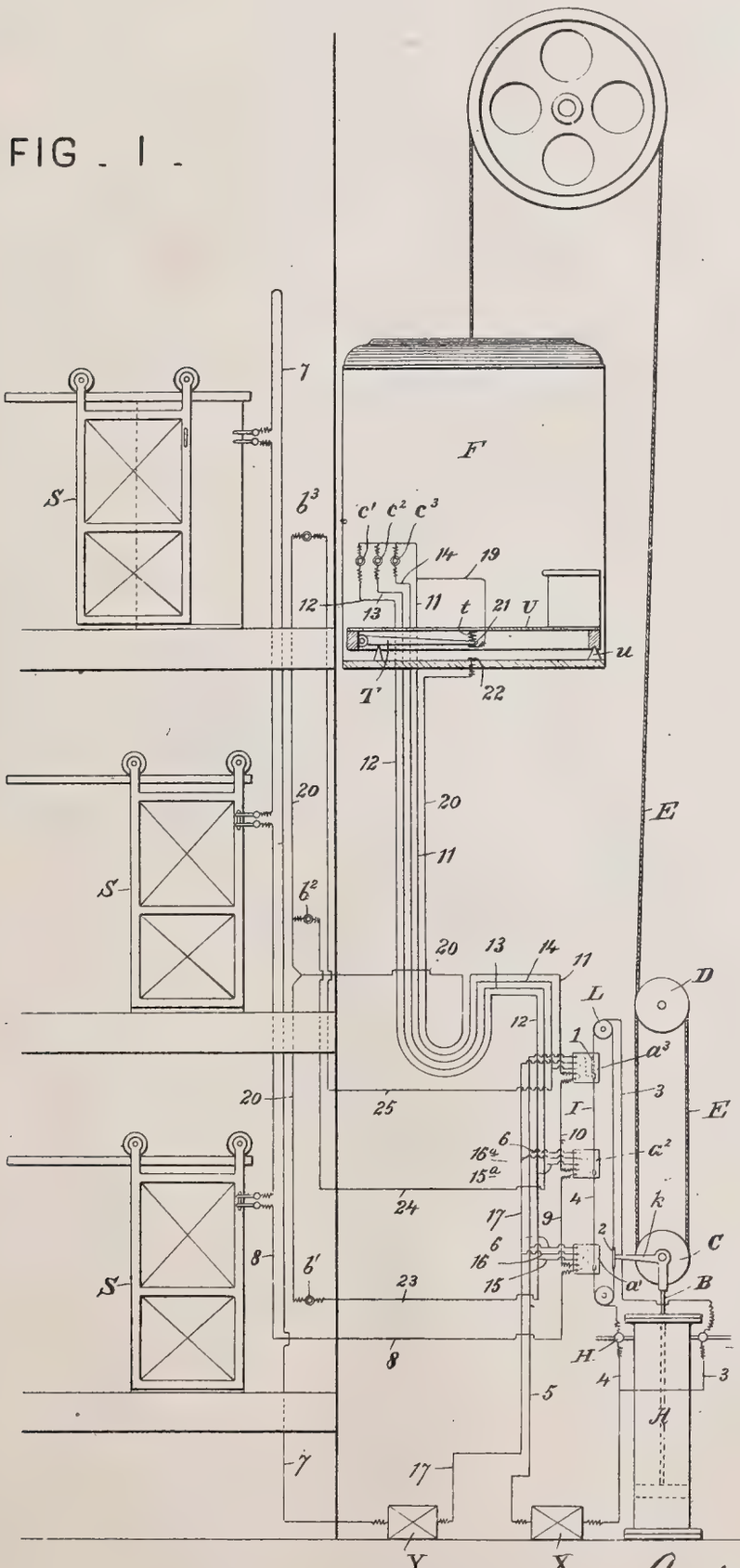
(No Model.) 2 Sheets—Sheet 1

A. M. COYLE.

ELECTRICALLY CONTROLLED ELEVATOR.

No. 471,100. Patented Mar. 22, 1892.

FIG. 1.



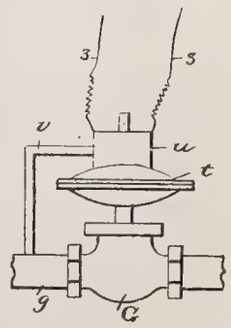


FIG. 1.a

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Jonathan Coley.

Inventor:
Andrew M. Coyle
by Pollok & Mauro,
his attorneys.

THE CCKERT LITHOGRAPHING CO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

A. M. COYLE.

ELECTRICALLY CONTROLLED ELEVATOR.

No. 471,100. Patented Mar. 22, 1892.

FIG. II.

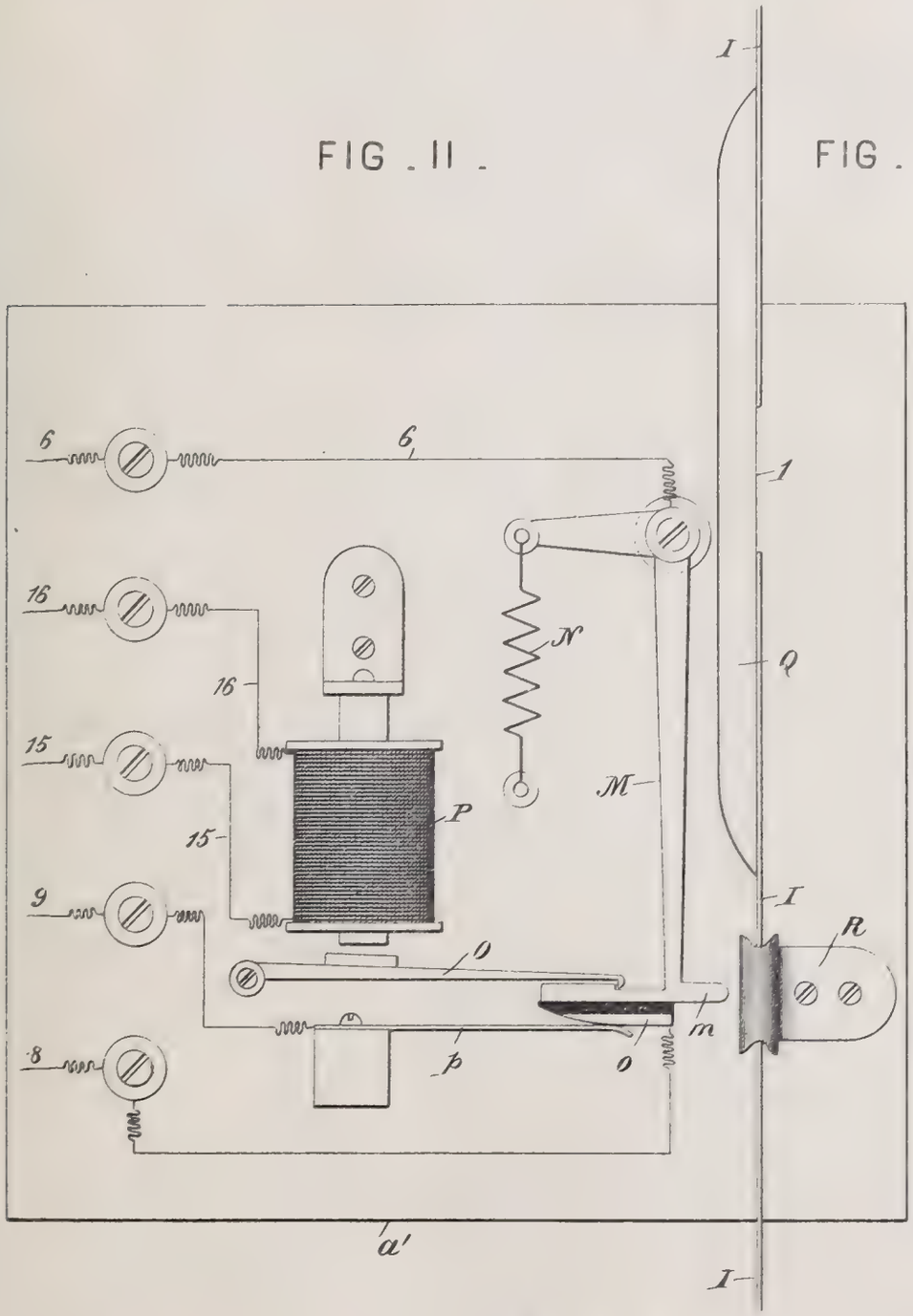


FIG. III.

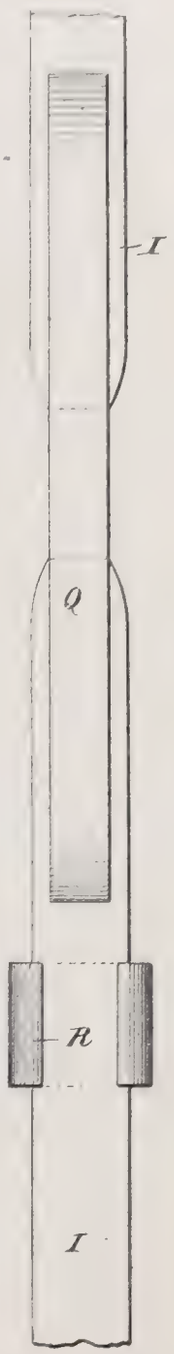


FIG. V.

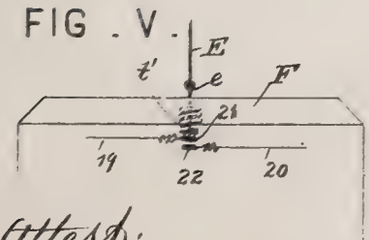


FIG. VI.

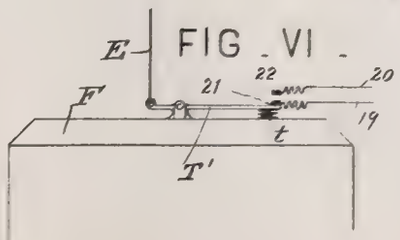
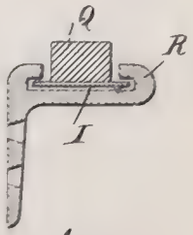
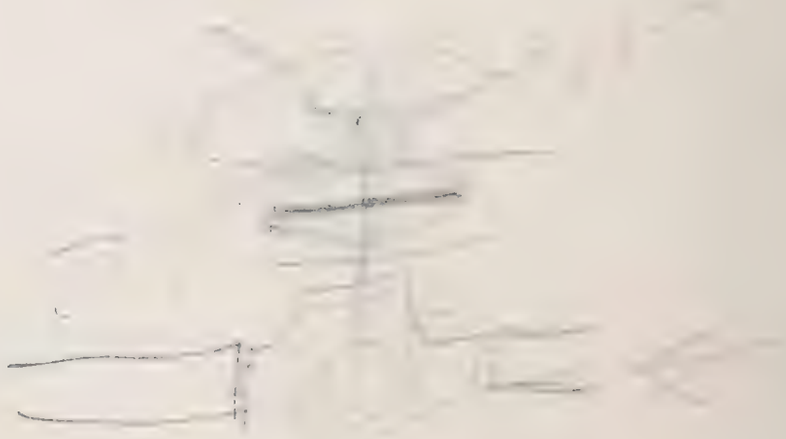


FIG. IV.



Attest:
Geo. T. Smallwood.
Jouaston Riley.

Inventor:
Andrew M. Coyle
by Pollok & Mauro
his attorneys.



UNITED STATES PATENT OFFICE.

ANDREW M. COYLE, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO NELSON HISS, OF BALTIMORE, MARYLAND.

ELECTRICALLY-CONTROLLED ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 471,100, dated March 22, 1892.

Application filed May 23, 1891. Serial No. 393,900. (No model.)

To all whom it may concern:

Be it known that I, ANDREW M. COYLE, a resident of the city of Washington, District of Columbia, have invented a new and useful Improvement in Electrical Apparatus for Elevator Control, which improvement is fully set forth in the following specification.

This invention relates to electrical apparatus or appliances for controlling the movements of an elevator-car from the several landings or floors of a building and from within the car itself, the object being to render unnecessary the services of an attendant for the car.

The invention contemplates means whereby all the desired movements of the car can be effected safely and with certainty without the exercise of any more care and intelligence than is required to touch a button corresponding to the number of the floor to which the car is desired to move. To this end the system comprises a series of parallel or branch circuits, one for each floor, and electrically-operated devices so constructed that when one of the switches or push-buttons is actuated the car will move to and come to rest at that floor, no matter whether the car be above or below the floor. This arrangement has obvious advantages over that which requires one operation to cause the elevator to ascend and another to cause it to descend.

Electrical systems for controlling elevators have heretofore been devised by the aid of which the car can be controlled either from the different floors or from within the car itself; but in such systems interference and confusion are likely to occur in case some one at one of the landings attempts to control the car while it is in use. According to the present invention means are provided whereby no one at any of the floors can control the movement of the car so long as the same is occupied. This is or may be practically accomplished by leading the outside or floor circuits (as distinguished from the inside or car circuits) through a switch-lever or circuit-changer, which is operated the moment a person enters the car, (as by his weight on the floor,) so that outside control of the car is prevented until he leaves it.

The system is applicable to elevators employing motor mechanism of any sort and is connected in such manner as to operate the stopping, starting, and reversing devices, which may be the valves of an ordinary hydraulic system or a belt-shipper or other well-known mechanism.

In carrying out my invention I employ a main circuit in two parallel branches, including a generator. When the current flows in one branch, the proper device is actuated to cause the car to ascend, when it flows in the other branch the car descends, and when both branches are open the car is at rest. I employ a secondary or auxiliary circuit which branches to each floor and also to a number of switches or push-buttons in the car equal to the number of floors. The function of these circuits is simply to operate the main-circuit closer. There is one such main-circuit closer for each floor, and the main circuit includes a movable portion (which may be a metallic ribbon or band) which moves with or in unison with the elevator-car, and this movable portion consists of two sections insulated from each other, one section being permanently connected with that branch of the main circuit which causes the ascent of the car and the other with that branch which causes its descent. It follows that when the main-circuit closer, say of the second floor is actuated the current will flow through one branch if the car be above that floor and through the other if it be below that floor, causing the car to move either up or down, as may be required. The moving band carries a mechanical circuit-breaker whose position with reference to the main-circuit closers is always the same as the position of the car with reference to the several floors which these circuit-closers represent. This circuit-breaker therefore acts to open the main circuit and throw the circuit-closer back to its normal position at the moment when the car reaches the floor at which it is desired to stop, and the car accordingly comes to rest. The main-circuit closers could, of course, be at the different floors, and the circuit-breaker be carried by the car itself; but it is obviously advantageous to reduce the length and complexity of the main circuit by

employing a band or equivalent device moving in unison with the car, but over a much shorter path.

The invention, in addition to the main features above indicated, includes certain details of construction and combinations and arrangements of parts, as hereinafter set forth.

In the accompanying drawings, which form part of this specification, Figure I is a diagrammatic view illustrating the electrical connections of the entire system. Fig. I[a] is a detail indicating the position of electric valves. Fig. II is a detail of one of the main circuit-closers. Figs. III and IV are details of the moving band or carrier and the circuit-breaker, and Figs. V and VI are details of the circuit-changer for disconnecting the outside circuits.

In Figs. I, V, and VI the circuits are shown as disconnected at the elevator-car, which is assumed to be loaded.

In Fig. I the system is shown as applied to an ordinary hydraulic elevator of which A represents the cylinder; B, the piston; C, the sheaves connected with the piston; D, the stationary sheaves; E, the hoisting-rope, and F the car. G represents the inlet-valve by which water is admitted to the cylinder to force the piston down, (raising the car,) and H the outlet-valve.

Fig. I[a] indicates the application of a well-known form of electric valve in which the motions of a flexible diaphragm in chamber *t* are controlled by electro-magnets inclosed in a box *u*. The valve G in pipe *g* follows the movements of the diaphragm, being opened when the latter is raised and vice versa. *v* is a pipe connecting the chamber *t* with pipe *g*. It is to be understood that this valve forms no part of my invention, but being a device in common use is shown merely as an example of one means which may be adopted to carry the invention into effect when applied to hydraulic elevators.

The multiplying sheaves C D amplify the motion of the piston, which travels, say, one-fourth the distance of the car. The endless band or carrier I is connected by an arm *k* with the piston B, and therefore travels in unison with the car, but over a smaller path. This band runs over small sheaves L and carries portions of both branches of the main electric circuit which operates the valves G H. The band may be conveniently in the form of a metallic ribbon whose continuity is interrupted at the two opposite points 1 and 2, Fig. I. That portion of the band which is above the break 1 is permanently included in branch 3 of the main circuit, while that part which is below 1 is permanently connected with the branch 4.

The switch-boards a' a^2 a^3—one for each floor—are arranged at distances apart corresponding to the distance between the floors, and each is provided with main-circuit closing mechanism, such as shown in Fig. II, and hereinafter described. The main circuit proceeds from the generator X by wire 5, which connects by branch wires 6 with the main-circuit closers at the several switch-boards, (see Fig. II,) at each of which the circuit is normally open, thence it returns to the generator by the band I and the branch 3 or 4, as the case may be.

The circuit-closer M, Fig. II, is a pivoted lever having a contact-point *m* and provided with a spring N, which tends to force its contact-point against the traveling band I, and thus electrically connect the wire 6 with said band. The latch O normally holds the circuit-closer out of contact with the band; but when the circuit of the magnet P is closed the circuit-closer is free to close the main circuit.

Q is the mechanical circuit-breaker attached to the band I at the point *l* where the metallic strips are separated. It moves through the guide R, as shown in Figs. III and IV, and throws back the circuit-closer M until the latter is caught by its latch O.

As the operation of working the valves or operating other starting mechanism requires considerable energy, I have made the main circuit short and of as low resistance as possible, using a separate circuit supplied by the generator Y (or it may be by the same generator X) for the contacts and switch mechanism in the car F and on the several floors. Other advantages attend this arrangement, as will be seen hereinafter.

The secondary circuit requires very little energy, the only work it has to do being to energize the magnet P, which releases the main-circuit closer M. Each floor has a switch or push-button b' b^2 b^3. Switch b' on floor 1 is in the circuit of the magnet P on switch-board a', which corresponds with the first floor, and so on. In the car are three similar switches or push-buttons c' c^2 c^3, controlling the circuit-closers at the switch-boards a' a^2 a^3, respectively.

The course of the auxiliary circuit and its several branches can be readily traced on Fig. I. Beginning at one pole of the generator Y the wire 7 runs through contacts controlled by the doors S on the several floors. This prevents the main circuit from being closed and consequently the car from moving so long as any door is open. This expedient, however, is not broadly new. From the last door the circuit continues by wire 8 to the switch-board a', where it is closed through contacts *o p*, when the main-circuit closer M is in its normal position, Fig. II. The secondary circuit, therefore, is broken as soon as the main circuit is closed, which prevents more than one main-circuit closer M from closing the main current at the same time. It is not likely that two buttons would be pressed at exactly the same instant; but to avoid confusion from such an event I propose to make the loops from the several floors of different resistance, so that one magnet will act more promptly than the others. The circuit con-

tinues from switch-board a' by wire 9 to switch-board a^2 and by wire 10 to switch-board a^3, each of which has a similar provision for breaking it. It then proceeds by wire 11 to a rope or cable which follows the elevator-car, and in the latter it divides into three normally-open branches 12, 13, and 14, which include, respectively, the switches or push-bottoms c' c^2 c^3, corresponding with the several floors of the building. Following the branch 12 we find it returns through the rope or cable referred to, to the lower switch-board a', connecting by wire 15 with one end of the magnet-coil P and by wire 16 with the main return wire 17 to the opposite pole of the generator Y. It will be seen by examination of the diagram that the branches 13 and 14 are similarly connected with the switch-boards a^2 and a^3, respectively, and with the main return wire 17. Returning now to wire 11 we find that before it reaches the push-buttons in the car it connects with a branch wire 19, leading to a movable contact 21, which is carried by a lever or scale-beam T and normally pressed by a spring t against a fixed contact 22 on the floor of the car. The weight of a passenger standing on the false bottom U, which is pivoted at u, causes beam T to tilt by pressing on the short arm thereof, thereby separating contacts 21 and 22, and as these contacts are in the circuit of the external push-buttons b' b^2 b^3 it follows that the elevator cannot be controlled from the floors or landings so long as the car is occupied. This circuit is completed as follows: From fixed contact 22 a wire 20 branches to each push-button. From button b' a wire 23 runs to wire 15, thence to the magnet P of the first switch-board a', and thence to the generator by wires 16 and 17. In like manner the push-buttons b^2 b^3 are connected by wires 24 and 25, respectively, with their corresponding switch-boards.

The operation of the system will now be explained. The car being at the top floor, as shown in Fig. I, the circuit-breaker Q will be between the circuit-closer M of the top switch-board a^3 and the traveling band I. The door S of the top floor must be closed before the car can move, and it is preferred to have means for automatically closing the doors, as commonly employed. A person on the first floor now desires to use the car and pushes push-button b'. Here an advantage of using a separate main circuit is seen, for it is not necessary for the person to hold his button down until the car arrives. A momentary contact closes the auxiliary circuit through the magnet P at switch-board a', and the car at once starts and continues to move until it reaches the first floor. Neither is it necessary to ascertain whether the car be above or below the landing and to operate the proper valve to make it descend or ascend, as the case may be. We have seen that the division 7 between the two metallic strips of band I is at the top floor. Consequently as soon as button b' is pressed magnet P at board a' is energized, latch O is lifted, circuit-closer M released, and the main circuit closed thereby, the current flowing through the branch 4, which causes the descent of the car. Had the car been below the first landing, the current would have flowed through the branch 3. The car having started continues its descent, and circuit-breaker Q travels down in unison with it until it reaches the point of lever M at board a', which it forces back until engaged by latch O. At this moment the car reaches the first landing, and the main circuit, being broken, comes to rest. During its descent no one at an intermediate station could control and arrest it, for as soon as lever M was released it broke the auxiliary circuit between the wires 8 and 9 by separating-contacts o p. (See Fig. II.) The person who has called the car can then open the door, which again breaks the secondary circuit, and as soon as he enters the car and before the door can be closed behind him his weight has separated the contacts 21 22, as already explained, thus breaking the outside branches of the secondary circuit. When the door is closed, he touches the button in the car corresponding to the floor to which he desires to go—say button c^2. This closes the circuit of magnet P' at board a^2, the circuit being by wire 15^a to the magnet and 16^a to the main return-conductor 17. As the break 1 in the traveling part of the main circuit is now beneath the second floor switch-board a^2, the main circuit is closed by circuit-closing lever M through the branch 3, causing the car to ascend until the circuit-breaker Q again opens it, when it acts on the lever M at the board a^2 and brings the car to rest at the second floor.

For the sake of simplifying the description I have shown the connections for but three floors; but it will be obvious to persons skilled in the art that it may be applied to any desired number of floors or landings. It will be obvious, also, that some of the improvements may be used without others, and that details of construction may be modified without departing from the spirit of the invention.

The provision for preventing interference with the movements of the car while in use by automatically breaking all the outside circuit connections is considered an important feature of the invention, and it may be carried out in different ways. For example, as shown in Fig. V, the hoisting-rope E is connected to an eyebolt e, which bears upon a spiral spring t', which is sufficiently strong to keep the terminal 21, carried by the eyebolt, in contact with the fixed terminal 22 as long as the car is empty. When the weight is increased by the entrance of a person into the car, the contacts will be separated, as shown. The arrangement shown in Fig. VI is similar in operation. The rope E is attached to a lever T', beneath which is a strong spring l, which keeps the contact-plates 21 22 together when the car is empty, but is compressed when

the normal weight is increased by that of a passenger or passengers.

I claim—

1. In a system for controlling elevators electrically, the combination, with a starting and stopping mechanism, of a main electric circuit controlling the starting and stopping mechanism, a series of main-circuit closers for the several floors or landings, and a series of magnets in branches of an auxiliary circuit for operating said circuit-closers, substantially as described.

2. The combination, with the car and with starting and stopping mechanism, of the main controlling-circuit having two branches, two conducting-strips traveling with the car and connected with the two branches, respectively, main-circuit closers for each floor or landing, and circuit connections, as specified, for actuating each circuit-closer from the corresponding floor, so as to close the main circuit through one or the other branch, according as the car is above or below such floor, substantially as described.

3. The combination, with the car and with starting and stopping mechanism, of the main controlling-circuit having two branches, one to cause the ascent of the car and the other to cause its descent, two conducting-strips having their ends in close proximity and connected with said two branches, respectively, circuit-closers, one for each floor, adapted to make contact with one strip when the car is above the floor corresponding therewith and with the other when the car is below said floor, and a circuit-breaker also traveling with the car, so as to disengage each main-circuit closer as the car reaches the floor to which it corresponds, substantially as described.

4. The combination, with starting and stopping mechanism, of the main circuit having a movable portion, main-circuit closers for the several landings, and an auxiliary circuit having branches with switches or push-buttons at each landing and including magnets in each branch for controlling the corresponding circuit-closer, said auxiliary circuit including, also, a series of contacts, one of which is broken whenever one of the circuit-closers is actuated to close the main circuit, substantially as described.

5. The combination of the car, starting and stopping devices therefor, the main conducting-circuit, the two conducting-strips traveling in unison with said car, but at a less speed, and connected, respectively, with parallel branches of said main circuit, main-circuit closers, one for each landing, adapted to close the circuit through one or the other of said strips, an auxiliary circuit and magnets for actuating said circuit-closers, said auxiliary circuit having a normally-open branch at each landing and normally-open branches equal to the number of landings in the car, and circuit-closers, such as push-buttons, at the several landings and in the car, substantially as described.

6. The combination of the car, means for starting and stopping the car, a main controlling-circuit having two branches including, respectively, devices for starting the car in opposite directions, two conducting-strips electrically insulated but mechanically connected, said strips traveling in unison with the car and included, respectively, in the two branches, a series of main-circuit closers separated by distances proportional to the distance between the respective landings, and a circuit-breaker arranged at the point where the ends of the two conducting-strips approach each other, substantially as described.

7. In a system for electrically controlling the movements of an elevator-car, the combination, with the car and actuating mechanism therefor and with a circuit, including devices for starting the car in either direction, of a circuit-closer for each floor or landing and a circuit-breaker traveling with the car so as to open the circuit and arrest the car when the latter reaches the landing whose circuit-closer has been actuated, substantially as described.

8. In a system for electrically controlling the movements of an elevator-car, the combination, with the car and mechanism for starting and stopping the same, of a series of main-circuit closers, one for each landing, a main circuit having two branches, as specified, a circuit-breaker moving with the car so as to pass each circuit-closer as the car reaches the corresponding landing, and two disconnected conducting-strips connected, respectively, with the two branches of the main circuit extending in opposite directions from said circuit-breaker and moving therewith, substantially as described.

9. The combination, with the starting and stopping mechanism and the main controlling-circuit therefor, of the traveling band carrying a conducting strip or strips forming part of the main circuit, a series of pivoted levers constituting circuit-closers for said main circuit, an actuating-spring for each lever, a latch for holding the lever in opposition to its spring, a magnet in an auxiliary circuit for withdrawing said latch, and a mechanical circuit-breaker carried by said band, substantially as described.

10. In an electrical system for controlling the movements of an elevator-car, the combination, with the car, starting and stopping mechanism therefor, and circuits, including switches or push-buttons at the several landings and extending to the car, of contacts actuated by the entrance of a person into the car to open or disconnect the external circuits, substantially as described.

11. The combination, with electrical circuits and appliances for controlling the motion of an elevator-car from the several landings of a building, of a switch or circuit-changer actuated by the weight of a person in the car for opening or disconnecting said circuits, substantially as described.

12. The combination of the elevator-car, electric circuits and appliances for controlling the same, a movable platform in said car, and a switch or circuit-breaker actuated by said platform in one direction and by a spring in the other, substantially as described.

13. The combination of the elevator-car, electric circuits and appliances within and external to the car for controlling the same, including push-buttons in the car, and a switch or circuit-changer actuated by a movable platform in said car for opening the external circuits while the car is occupied, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ANDREW M. COYLE.

Witnesses:
PHILIP MAURO,
JONATHAN CILLEY.

(No Model.)

J. E. BARRY.

HYDRAULIC ELEVATOR.

No. 480,486. Patented Aug. 9, 1892.

Fig. 3.

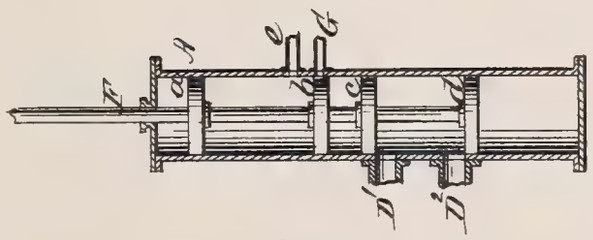


Fig. 2.

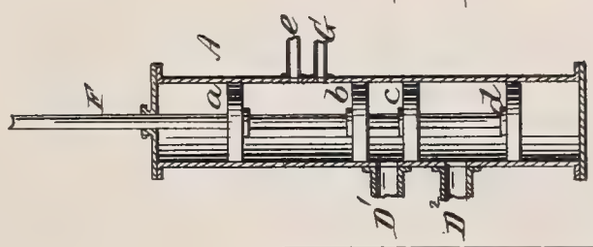
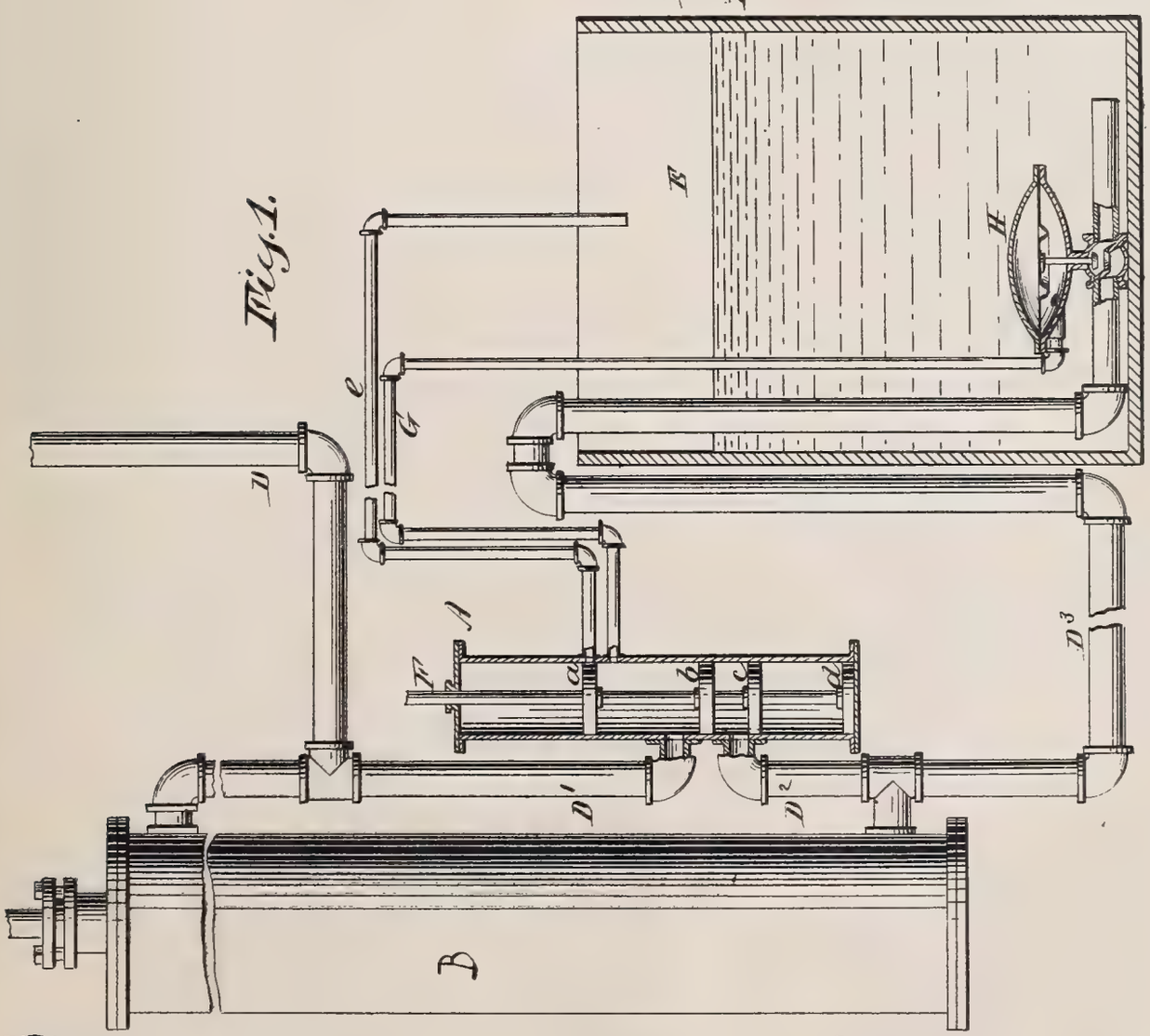


Fig. 1.



Witnesses:
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Jno. Mik Hall

Inventor:
Joseph E. Barry
by Dallin A. Clark
his attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOSEPH E. BARRY, OF NEW YORK, N. Y.

HYDRAULIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 480,486, dated August 9, 1892.

Application filed April 10, 1891. Serial No. 388,410. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH E. BARRY, of the city, county, and State of New York, have invented a new and useful Improvement in Hydraulic Elevators, of which the following is a specification.

My invention relates to elevators which are operated by means of a piston passing up and down through a long cylinder under the pressure of water, the different operations being effected by the movement of a valve-rod, with several disks upon it, operating in an operating-valve, which is connected with the top and bottom of the cylinder. A fault connected with such hydraulic elevators not hitherto overcome has been the scraping or sawing noise heard at the stopping and starting of the elevator during its ascent. The cause of this noise is the passage of the water under high pressure through the narrow opening at some one of the ports of the operating-valve as the edge of a disk on the valve-rod passes such port. The noise occurs just after the elevator starts in ascending and just before it stops in ascending—that is, while the port through which the water is passing under high pressure is throttled. It is not feasible to operate the valve-rod quickly enough to prevent this noise.

My invention consists, in general, of the combination, with the operating-valve, of a positively-operated valve placed in the discharge-pipe—that is, such valve being operated in connection with the operating-valve itself, but by some means independent of the discharge-water; also, of certain apparatus and arrangement thereof by which such valve in the discharge-pipe may be operated by the main water-pressure. By this means the point at which the noise is caused is removed from the operating-valve to the valve in the discharge-pipe, and so may be placed at any convenient point in the building where it will not cause annoyance, and, also, by this means the noise may be greatly lessened by the form of valve to be used in the discharge-pipe.

In the accompanying drawings, in which the same characters indicate analogous parts, Figure 1 represents the apparatus complete with the operating-valve in the position for ascent. Figs. 2 and 3 represent the same operating-valve in the two other positions—viz., for stopping and for descent, respectively.

Figs. 1, 2, and 3 show the operating-valve by means of the different positions of which the elevator is made to ascend, stop, or go down. In Fig. 1 the operating-valve is in the position it takes in order to cause the piston to descend and the elevator to ascend. Fig. 2 is the position which the operating-valve is made to take in order to cause the piston and the elevator to stop, and in Fig. 3 the position is that the operating-valve is made to take in order to cause the piston to ascend and the elevator to descend.

B is the ordinary water-cylinder full of water and connected through the pipe D to the tank on the roof or other water-supply under pressure and having within it a piston and piston-rod attached to one end of a rope, the other end of which supports the elevator, so that as the piston descends the elevator ascends and as the piston ascends the elevator descends. The pipe D′, open both to the upper part of the water-cylinder B and to the inlet-pipe D, opens into the operating-valve A. The pipe D^2 connects the bottom of the water-cylinder B and the operating-valve A. The pipe D^3 is the discharge-pipe and is open to the bottom of the water-cylinder B. This pipe D^3 is shown in this drawing as passing into the discharge-tank E.

In the operating-valve A the valve-rod F moves, having the four disks or pistons *a*, *b*, *c*, and *d* attached thereto. From the upper part of the operating-valve A a small pipe G connects the operating-valve A with a valve H at the end of the discharge-pipe D^3. The valve H may be placed at any other convenient point in the discharge-pipe, the object being to remove it from any place where the noise would cause annoyance.

In the drawings the valve H is shown as operated by a flexible diaphragm, the pressure of the water underneath the diaphragm pressing it and with it the valve upward, and the elasticity of the diaphragm returning the parts and closing the valve when the water-pressure under the diaphragm is removed, the operation being such that when the pressure of the water is open through the pipe G to the diaphragm in the valve H the valve H

in the discharge-pipe is open, so that the water may be discharged from the water-cylinder B into the tank E.

In order to allow the valve H to be closed by the resilience of the diaphragm alone, the diaphragm should be made of resilient material of appropriate strength. The space in the valve-chamber above the diaphragm may also be made air-tight, so as to act as an air-cushion, the pressure of the air compressed by the upward movement of the diaphragm tending to press down the diaphragm and thus close the valve when the pressure of the water through the pipe G underneath the diaphragm is removed. A device equivalent to the diaphragm would be a spiral spring around the valve-rod compressed by the upward movement of the valve. A pipe *e* is also connected with the operating-valve A for the purpose of relieving the pressure under circumstances to be explained. The pipe G, I shall call the "diaphragm-pressure" and the pipe *e* the "diaphragm-relief."

The apparatus operates in the following manner, namely: When the elevator is to be made to ascend, the valve-rod F and pistons *a*, *b*, *c*, and *d* in the operating-valve A are placed in the position shown in Fig. 1. In such position the pressure of the water from the tank or other source of supply is open through the pipe D′, the operating-valve A, and the diaphragm-pressure G to the valve H. This opens the valve H in the discharge-pipe, and the water then discharges through the pipe D^3 from below the piston in the water-cylinder B, and this causes the elevator to ascend. When the motion is to be stopped, the operating-valve is placed in the position shown in Fig. 2. In such position the pressure of the water is shut off from the diaphragm-pressure G, and the pressure is also relieved through the diaphragm-relief *e*, so that the valve H closes and stops the outflow of the water. As there is therefore no escape for the water underneath the piston within the water-cylinder B, the piston and elevator stop. When the elevator is to be made to go down, the operating-valve is placed in the position of Fig. 3. In such position the water has free circulation through the pipes D′ and D^2 and the operating-valve A, the pressure being also shut off in that position from the diaphragm-pressure G. The valve H is kept closed and prevents the escape of water from the discharge-pipe, and the elevator descends by gravity.

Any appropriate means of positively operating the valve H so that it will be opened when the elevator is made to ascend and shut at all other times may be used. By the form shown the water-pressure is used as the operating force; but other methods will easily suggest themselves—such, *e. g.*, as some positive connection with the operating-rope.

This invention is entirely distinct from those devices which operate to throttle the discharge-pipe—such, *e. g.*, as a valve in the discharge-pipe automatically operated by the pressure of the discharge-water. Such devices only accomplish the purpose by a proportionate loss of power which is necessarily involved in throttling the discharge-opening; but the valve H in my invention does not throttle the pipe D^3 at all, but allows the full opening whenever the water discharges. At all other times it entirely prevents all discharge of water.

I claim as my invention—

1. In hydraulic elevators, the combination of an operating-valve, a separate valve in the discharge-pipe, and means, substantially as described, whereby the valve is controlled by the fluid under pressure from the primary source of supply.

2. In hydraulic elevators, the combination of an operating-valve and a separate positively-operated valve in the discharge-pipe, a pipe connecting such valve in the discharge-pipe with the operating-valve, through which the water-pressure is applied to operate such valve, and a relief-pipe connected with the operating-valve to relieve the pressure upon the valve in the discharge-pipe.

3. In hydraulic elevators, the combination of an operating-valve having four disks or pistons and having no discharge-pipe directly connected therewith, a separate positively-operated valve in the discharge-pipe, a pipe leading from the operating-valve to the valve in the discharge-pipe to operate such valve by the main water-pressure, and a relief-pipe connected with the operating-valve to relieve the pressure upon the valve in the discharge-pipe.

In witness whereof I have hereunto set my name, this 21st day of March, 1891, in the presence of two witnesses.

JOSEPH E. BARRY.

Witnesses:
CHARLES W. COLEMAN,
SALTER S. CLARK.

(No Model.)

A. J. McADAM.

ELEVATOR CONTROLLING MECHANISM.

No. 482,131. Patented Sept. 6, 1892.

Fig. 1.

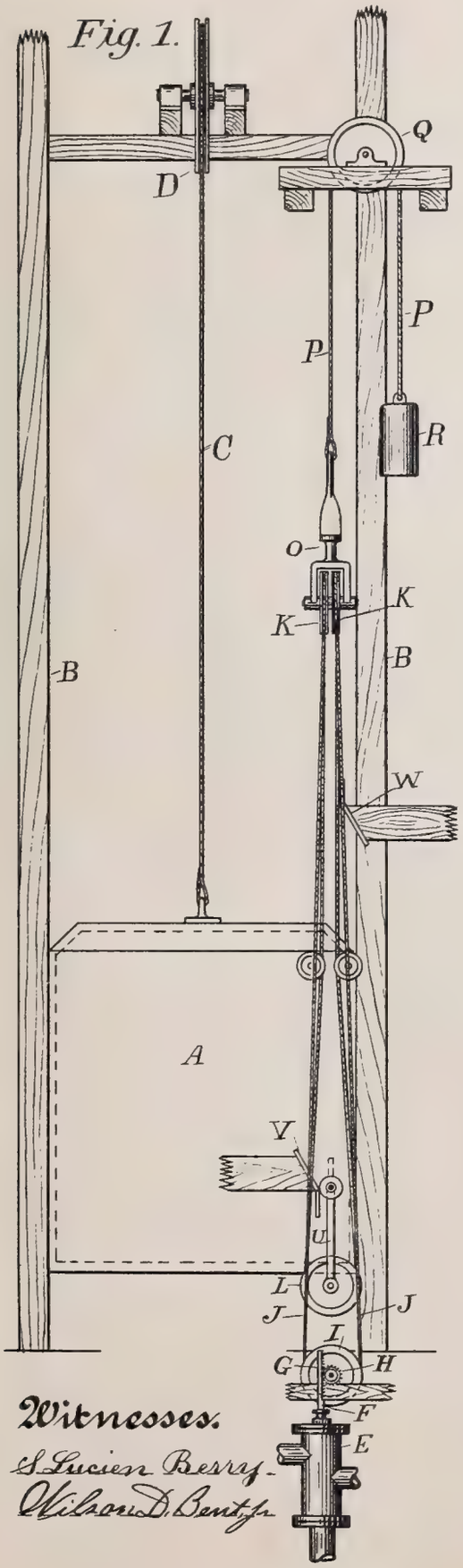
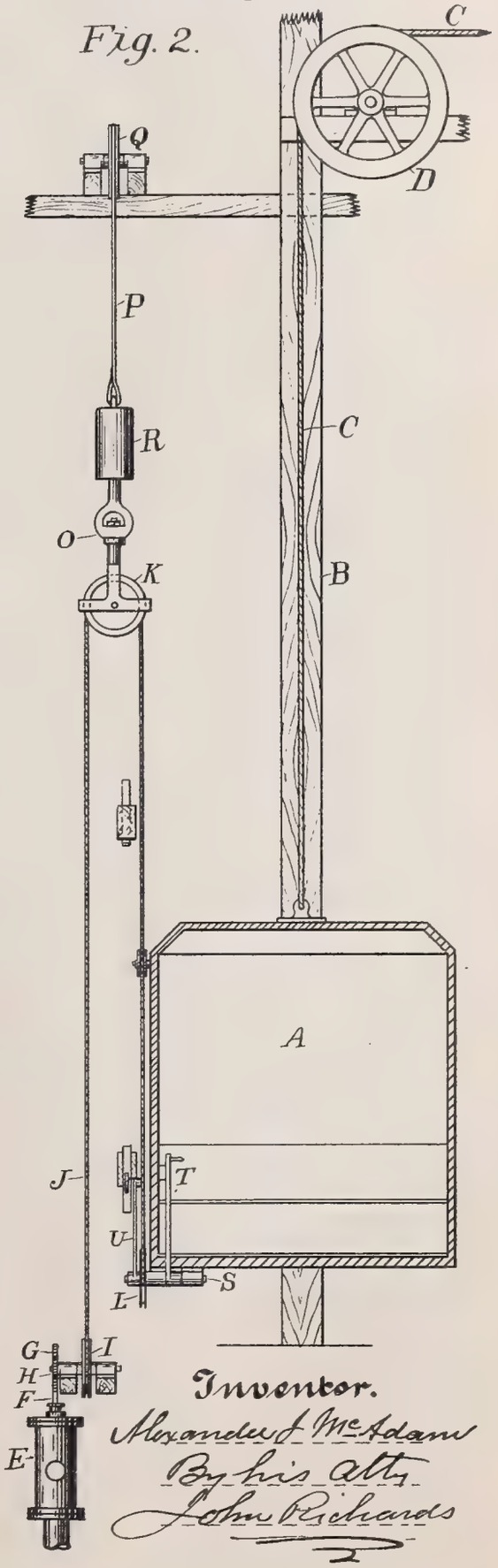


Fig. 2.



Witnesses.

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Wilson D. Bentley Jr.

Inventor.

Alexander J. McAdam
By his Atty.
John Richards

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ALEXANDER J. McADAM, OF SAN FRANCISCO, CALIFORNIA.

ELEVATOR-CONTROLLING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 482,131, dated September 6, 1892.

Application filed April 21, 1892. Serial No. 430,082. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER J. McADAM, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Elevator-Controlling Mechanism; and I hereby declare the following specification, with the drawings forming a part of the same, to be a full and complete description of my invention.

My invention relates to elevators for raising or lowering passengers or goods and to maintaining from the cages thereof convenient control of the valves in the case of hydraulic elevators or the driving-gearing in the case of elevators driven by belts or shafts; and it consists in the employment of ropes or chains extended from the cage of such elevators to valves, belts, shifting devices, or other gearing for controlling the movements or stoppage of the cage, the ropes or chains passing over pulleys that take up the bight, so that the relation between the hand-operated mechanism and that actuated by the ropes or chains will remain the same in all positions of the cage and may be attached to levers or other devices therein.

Referring to the drawings, Figure 1 is a diagram or elevation of an elevator-cage and its connected parts arranged according to my invention. Fig. 2 is a view, partially in section, of the same elevator in a plane at right angles to Fig. 1.

Similar letters of reference on the two figures indicate corresponding parts.

The cage A moves between and is guided by the posts B B in the usual manner and is suspended by a rope C, passing over a pulley D; or the cage may be raised and lowered by means of a ram or piston beneath, my invention applying the same in either case.

At E is shown a valve such as controls the flow of water or the movements of the cage in a hydraulic elevator. The piston F of the valve is actuated by a rack G and pinion H, operated by a pulley I. Passing partially and oppositely around this pulley I and attached to the periphery thereof are two ropes J J. These ropes pass from the pulley I over two movable ones K K, and thence down to a fourth one L, mounted on and moving with the cage A. The ropes J J pass partially and oppositely around and are fastened to the periphery of this pulley L, the same as in the case of the one I, so as to produce a coincident movement of the two. On the axis S of the pulley L, mounted on the bottom of the cage A, is placed a lever T, by means of which an attendant in the cage can turn the pulley L to the right or to the left, and at the same time move the one I and the rack G by means of the ropes J J to the same extent or as the relative diameters of the two pulleys may determine. The lever T also serves as a means by which to adjust the pulley L and the pulley I simultaneously, so that the cage will ascend, descend, or stop.

Thus far my description applies to the cage and other parts when stationary and when the ropes J J are operating from fixed positions; but when the cage ascends or descends and the relative positions of the pulleys I and L are changed the tension of the ropes J J must be maintained accordingly. To do this, I employ the pulleys K K, mounted in a frame or shackle O, suspended by a rope P, passing over a pulley Q and attached to a movable weight R. As the cage A moves up or down these pulleys K K move in the same direction at one-half the speed of the cage, keeping the two ropes J J taut and maintaining the connection between the two pulleys I and L. On the same axis S there is a second lever U, which, on the extreme up or down stroke of the cage A, comes in contact with the stops V and W, so that the ropes J J and wheels L and I will be moved automatically and the cage stopped accordingly. The stop W is, of course, placed at the highest range of the cage and the one V at the lowest point. The tension-pulleys K K can be set in any position with respect to the cage—that is, their axis may be transverse to the position shown—and the ropes J J can be led in any direction over the idle-pulleys to reach valve or belt shifting mechanism distant from the cage, and also the wheels or pulleys I and L can be substituted with levers or cranks, such change being necessary to meet the requirements of special circumstances and in no way changing the nature of my invention.

Having thus described the nature and objects of my invention, what I claim, and desire to secure by Letters Patent, is—

1. In elevator-controlling gearing, the combination of the cage A, the water-controlling means consisting of a cylinder, piston, rack and pinion, and pulley I, up-and-down-traveling pulleys K K, pulley L, attached to the cage, ropes J J, passed partially and oppositely around and fastened to the pulleys I and L, hand-lever T, attached to the axle of the pulley L, rope P, suspended shackle-pulley Q, and movable weight R, substantially as described.

2. In elevator-controlling gearing, the combination of the cage A, the water-controlling means consisting of a cylinder, piston, rack and pinion, and pulley I, up-and-down-traveling pulleys K K, pulley L, attached to the cage, ropes J J, passed partially and oppositely around and fastened to the pulleys I and L, hand-lever T, attached to the axle of the pulley L, rope P, suspended shackle-pulley Q, and movable weight R, lever U, and stops V and W, substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two witnesses.

ALEXANDER J. McADAM.

Witnesses:
ALFRED A. ENQUIST,
WILSON D. BENT, Jr.

(No Model.) 2 Sheets—Sheet 1.

W. J. ROCHFORD & E. W. KEMPTER.

ELEVATOR.

No. 484,766. Patented Oct. 18, 1892.

Fig. 1.

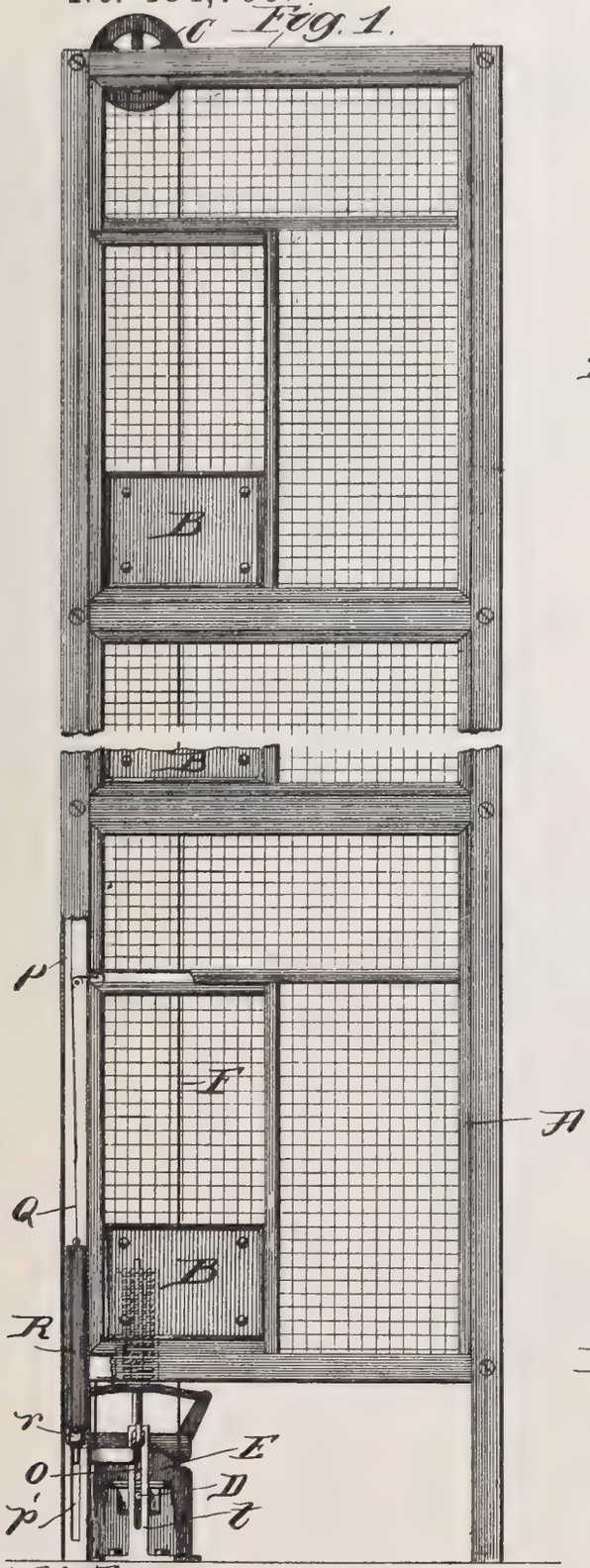


Fig. 4.

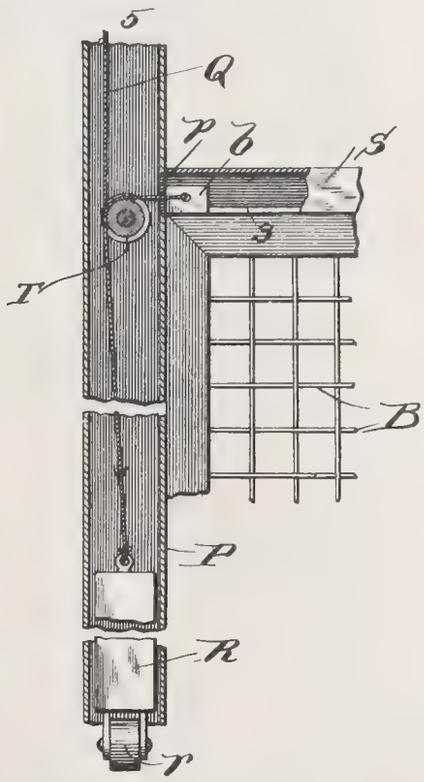


Fig. 5.

Fig. 6.

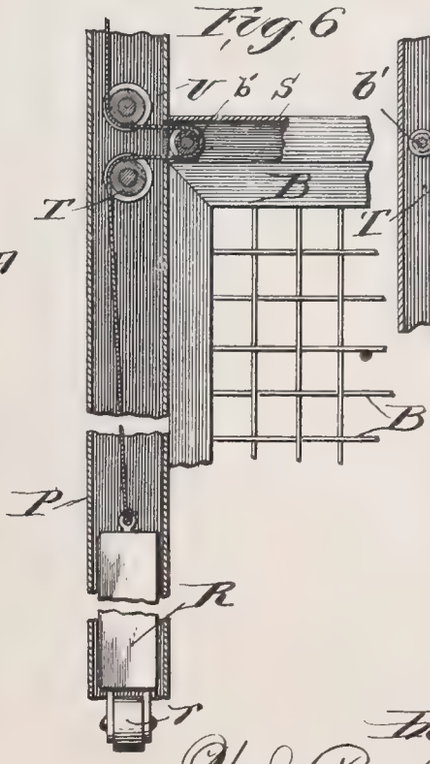
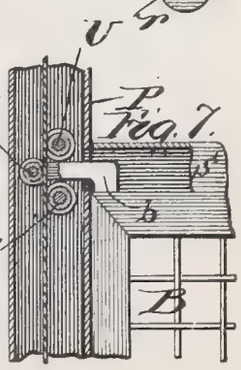


Fig. 7.



Witnesses:
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Inventors:
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THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2

W. J. ROCHFORD & E. W. KEMPTER.

ELEVATOR.

No. 484,766. Patented Oct. 18, 1892.

Fig. 2.

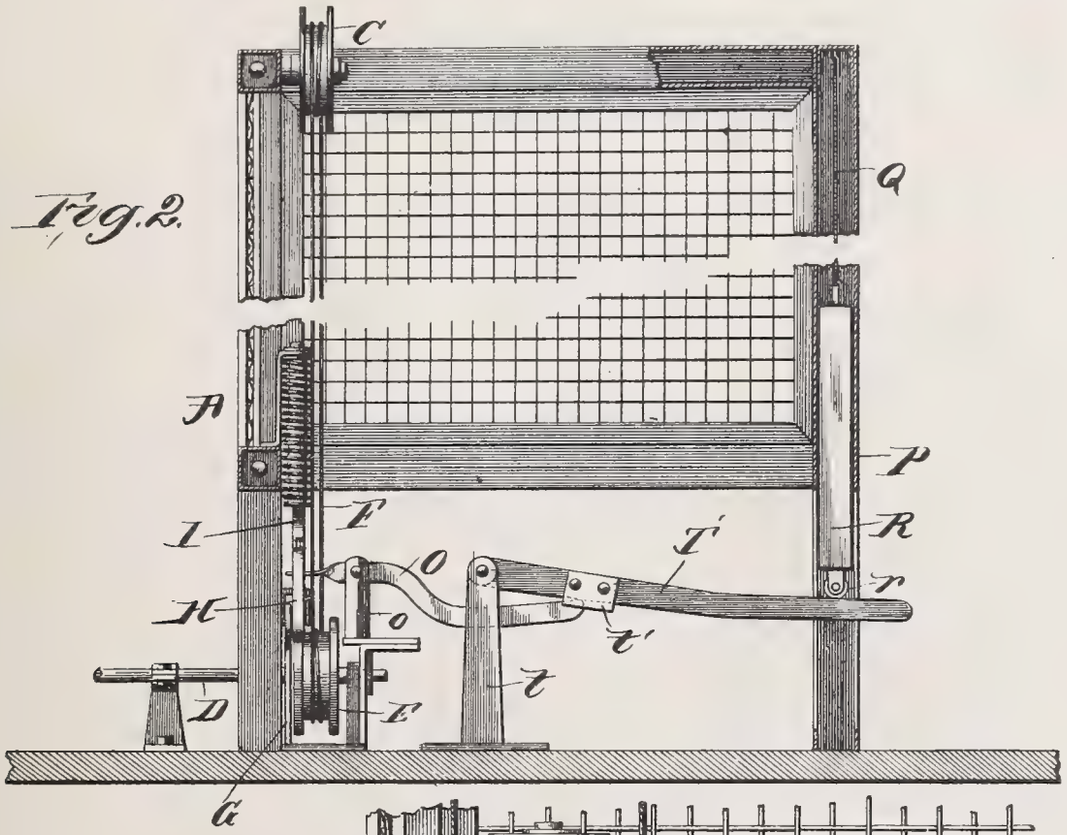
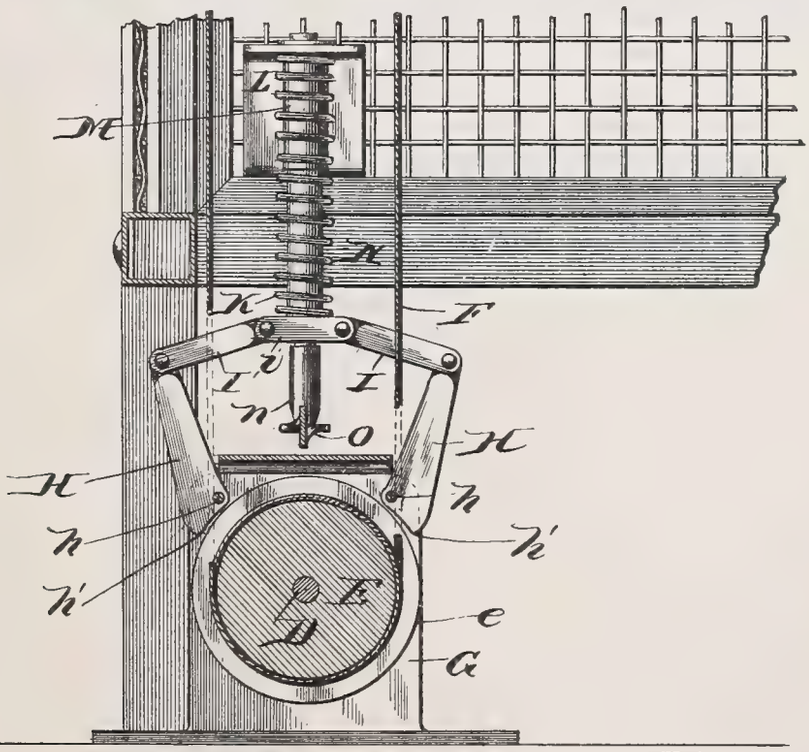


Fig. 3.



Witnesses:
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W. A. Fox.

Inventors:
W. J. Rochford and
E. W. Kempter
By Elliott Bros Quackenbush
Attys

THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WALTER J. ROCHFORD AND ERNEST W. KEMPTER, OF CHICAGO, ILLINOIS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 484,766, dated October 18, 1892.

Application filed February 1, 1892. Serial No. 419,970. (No model.)

To all whom it may concern:

Be it known that we, WALTER J. ROCHFORD and ERNEST W. KEMPTER, citizens of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Elevators, of which the following, in connection with the accompanying drawings, is a full, clear, and exact specification.

Our invention relates to improvements in controlling mechanism for elevators, and more particularly to that class of such devices employed for preventing the operator from accidentally or purposely starting the car either up or down while any of the doors of the elevator-shaft are open, thus avoiding the possibility of persons becoming injured by being caught between the moving elevator-car and the casement or sill of the door, it being well understood that a large percentage of the casualties incident to the use of elevators are due to this cause.

The object of our invention, therefore, is to provide improved means for preventing the movement of the car while any of the doors are open and which shall be very simple of construction, easy of and automatic in its operation, and applicable alike to all styles of elevators.

Our invention consists in certain features of novelty in the construction and combination of parts by which the said object and certain other objects hereinafter described are attained, and which will first be fully described with reference to the accompanying drawings, and then particularly pointed out in the claims.

In the said drawings, Figure 1 is a side elevation of an elevator-shaft having our improvements applied thereto, portions being broken away to disclose the interior mechanism and the car being omitted for the sake of simplicity. Fig. 2 is a similar view, on a larger scale, but looking from the side at right angles to that presented in Fig. 1, showing the upper and lower portions of the shaft, the intermediate stories being broken away. Fig. 3 is a detail view, on a larger scale, more particularly illustrating the brake and its retracting mechanism, as hereinafter described. Fig. 4 is a detail vertical section of the weight and cable box or casing, showing interior parts, as hereinafter described. Fig. 5 is a similar sectional view taken on the line 5 5, Fig. 4. Fig. 6 is a sectional view similar to Fig. 4, illustrating the modification of the manner of connecting the weight-cable to the doors; and Fig. 7 is a further modification of the same.

In the drawings, wherein like signs of reference refer to like parts throughout the several views, A indicates the elevator-shaft, which may be of the usual construction, provided at each story with the ordinary sliding door B, and at its upper and lower ends with the valve-rope sheave or pulley C and the valve-actuating shaft D, respectively.

In hydraulic elevators it is usual to provide the valve-shaft D with a pulley or drum, such as E, around which valve-rope F is wound and passes upward over its sheave C at the top of the elevator-shaft; but in other forms of elevators—such, for instance, as the steam-elevator—the drum E is not ordinarily employed, the rope F in such case being connected to the lever or some other similar device for actuating the shaft D, which latter, however, is invariably employed in one form or another. Therefore for the sake of brevity I will term the shaft D the "power-controlling shaft," which term will be understood to include any form of shaft or device through the medium of which the power for raising the elevator is controlled by means of a rope, such as F. Hence in applying our improvements to the forms of elevators not already provided with the drum E it is simply necessary to add such drum to the shaft D and pass the rope F around it in the manner shown in the drawings or any other suitable way.

Pivoted to the bracket or standard G, in which the shaft D is journaled, is a brake adapted to arrest the movement of the drum E, so as to prevent the rotation of the shaft D and the consequent application or shutting off of the power through the medium of the rope F. This brake preferably consists of two brake-shoes H, pivoted to the standard G at the points *h*, adapted to impinge one of the flanges *e* of the drum when the brake-shoes are oscillated or rocked away from each other upon their pivots. Each of these brake-shoes is provided, as more clearly shown in Fig. 3, with an elongated arm, and these arms are connected together by means of a toggle, which

consists, preferably, of the two links I, pivoted, respectively, at their outer ends to the arms of the shoes H and at their inner ends to the perforated head or block *i*, so that when such block is forced downward, straightening the toggle, the arms of the brake-shoes will be forced asunder and the noses *h'* of such shoes caused to impinge the drum with great force. The brake-shoes are held normally in engagement with the drum, and this is accomplished, preferably, by means of a coiled spring K, which bears between the block *i* and a bracket L, secured to the elevator shaft or frame in any suitable manner, and passing upward through this spring K is a telescopic shaft or pin whose upper end or portion M is rigidly secured to the bracket L, while its lower portion or end N is connected or secured in any suitable manner to the block *i*, and is provided with a pendent portion *n*, to which latter is pivoted the short arm of a lever O; but since the purpose of the telescopic shaft is simply to confine the spring to its proper location and permit the toggle to be bent upward for releasing the brake-shoes it is obvious that such shaft or pin might be formed in one piece and allowed to slide upward through an opening or socket in the bracket L, and that the lever O might be secured directly to the block *i* or to the telescopic shaft or pin proper, both of which modifications will be readily understood without further elaboration; but the construction shown is preferable, because the shaft M N is thereby rendered more rigid and requires less room for its operation.

Formed, preferably, in the frame or one corner of the elevator-shaft is a weight or cable box P, which extends throughout the height of such shaft, and is preferably in the corner adjacent to the edge or side of the door or doors bearing the latch or lock. In the upper end of this weight and cable box or casing P is secured the upper end of the weight-cable Q, which extends downward to a point near the lower end of the shaft and is there provided with a weight R, which is of sufficient size or specific gravity to cause the closing of any of the elevator-doors B. The casement or frame S above each of the doors B is preferably hollow and provided on its under side with a longitudinal slot *s*, through which passes and slides a lug *b*, which is formed on or otherwise secured to that corner of the door which is adjacent to the casing or box P, and to each of these lugs *b* is secured one end of a branch cable *q*, which passes over an idle pulley or roller T, suitably journaled in the box P, and has its other or lower end spliced, tied, or otherwise connected to the main cable Q, the side of the box P being provided with openings *p* for the passage of each of the branch cables *q*, and it being understood that such cables *q* should be at least as long as the width of the door. Thus it will be seen that whenever a door is opened in any story of the building the cable Q will be drawn upward by the branch cable *q*, and the weight R will consequently be lifted a distance equal to the movement of the door, and that when the door is released it will be automatically closed by the superior gravity of such weight R.

In order to govern the movement of the brake-shoes H by the movement of the doors B, we communicate the movement of the weight R to the lever O, so that when such weight descends in the act of closing the door the lever O will compress the spring K and release the brake-shoes, thus permitting the power-controlling shaft D to be actuated through the medium of the rope F. In order, however, that the spring K may be stout, so as to produce by the aid of the leverage afforded by the toggles I the requisite pressure upon the brake-shoes without the necessity of employing an excessively-large weight R, which would prove disastrous to the cable Q and render the opening of the doors B very laborious, we communicate the movement of the weight R to the brake-shoes and spring K through the intermediary of a compound lever, of which the lever O, a lever of the first order, is one member, while a lever T' of the second order is a second member. The lever T' is pivoted or fulcrumed in a standard or upright *t*, and its power end passes through the path or line of movement of the weight R, preferably through a vertical slot *p'* in the box P, so as to constitute a guide for this end of the lever. The lever O is pivoted or fulcrumed in a suitable standard or bracket *o*, and its power end or long arm passes through the standard *t*, so as to be guided thereby, and supports the lever T' by impinging the under side thereof between two guide-plates *t'*. Thus it will be seen that the gravity of the weight R is sufficient to overcome the inertia of the spring K, and yet offer but little resistance to the opening of the doors B.

In order to prevent the rotation of the weight R and the consequent twisting of the cables Q and *q*, we prefer to make the box P at its lower end—at least where the weight is located—non-circular in cross-section and to also form the weight of similar contour. As shown in the drawings, it is square or rectangular. The lower end of the weight R is also provided with an antifriction-roller *r*, which is suitably journaled in two depending ears formed on the lower end of the weight, so as to reduce the friction between the end of the lever T and the weight to a minimum. With an apparatus thus constructed it will be seen that so long as the weight R is in contact with the lever T' the brake-shoes *h'* will be held aloof from the periphery of the cable-drum E; but as soon as any of the doors throughout the height of the elevator-shaft are opened the said weight will be raised from the lever T' through the connections already described, and the spring K, through the medium of the arms or levers H, will force the brake-shoes firmly against the cable-drum, and thus render it impossible to turn such drum through

the medium of the rope or cable F, and hence the attendant will be unable to start the car until all of the doors are closed.

If desired, the branch cables *q* may be done away with and the main cable Q passed under an idler U, arranged a little above the idler T, and thence passed around a pulley *b'*, journaled on the lug *b* on the corner of the door, the cable then passing over the idler T, as before, whereby when the door is opened a loop of the cable will be drawn into the hollow portion S of the casement and the weight accordingly elevated. This construction, however, multiplies the resistance of the weight R upon the door and might be considered inferior to the preferred form before described for that reason.

As a modificati of the form shown in Fig. 6, the lug *b* may be extended into the box or casing P through the opening *p* and between the idlers T U, so that the pulley *b'* may be journaled in its end in such a position as to allow the main cable to hang vertically between the three pulleys, thus avoiding the necessity of overcoming the friction in opening a door, which is entailed by the cable running between the idlers T U and around the pulley *b'* on all the doors below the door being opened.

Having thus described our invention, what we claim as new therein, and desire to secure by Letters Patent, is—

1. In an elevator, the combination, with the shaft having doors, of a cable suspended in said shaft and connected to each of said doors, a weight secured to said cable, a power-controlling shaft, a drum on said power-controlling shaft, means for rotating said drum from the elevator-car, a brake for locking said drum against rotation, and a lever actuated by said weight for releasing said brake, substantially as set forth.

2. In an elevator, the combination, with the shaft having doors, of a cable suspended in said shaft and connected to each of said doors, a weight secured to said cable, the power-controlling shaft, a brake for locking said power-controlling shaft against rotation, means for actuating said power-controlling shaft from the elevator-car, and a compound lever for releasing said brake arranged in the line of movement of said weight, substantially as set forth.

3. In an elevator, the combination, with the elevator-shaft having doors, of a cable suspended in said shaft and connected to each of said doors, a weight secured to said cable, the power-controlling shaft, means for actuating said power-controlling shaft from the elevator-car, a brake for locking said power-controlling shaft against rotation, toggles for actuating said brake, a spring for actuating said toggles to hold the brake normally in engagement, and a compound lever for releasing said brake arranged in the line of movement of said weight, substantially as set forth.

4. In an elevator, the combination, with the elevator-shaft having doors, of a weight-box, a cable suspended in said box and connected with each of said doors, a weight secured to said cable, the power-controlling shaft, a brake for locking said shaft against rotation, and a compound lever for releasing said brake and projecting through said weight-box in the line of movement of said weight, substantially as set forth.

5. In an elevator, the combination, with the elevator-shaft having doors, of a suspended cable, branch cables connecting said doors with said suspended cable, a weight secured to said suspended cable, the power-controlling shaft, a brake for locking said shaft, and a lever for disengaging said brake arranged in the line of movement of said weight, substantially as set forth.

6. In an elevator, the combination, with the elevator-shaft having doors, of a suspended cable, branch cables connecting said first cable with said doors, pulleys over which said branch cables pass, a weight secured to said first cable, the power-controlling shaft, a brake for locking said shaft, and a lever for disengaging said brake arranged in the line of movement of said weight, substantially as set forth.

7. In an elevator, the combination, with the elevator-shaft having doors, of a non-circular weight-box, a cable suspended in said box and being connected with each of said doors, a non-circular weight secured to said cable in said box, the power-controlling shaft, and a brake for locking said shaft adapted to be disengaged by the movement of said weight, substantially as set forth.

8. In an elevator, the combination, with the elevator-shaft having doors, of the box P, a cable suspended in said box, the hollow slotted frames S, lugs on said doors, projecting into said hollow frames S, branch cables connecting said lugs with said first cable, pulleys over which said branch cables pass, a weight secured to said first cable, the power-controlling shaft, and a brake for locking said shaft adapted to be disengaged by movement of said weight, substantially as set forth.

9. In an elevator, the combination, with the elevator-shaft having doors, of a weight for holding said doors closed, the power-controlling shaft, a drum on said shaft, the rope F, passing around said drum, brake-shoes arranged to impinge said drum, toggles for actuating said brake-shoes, a spring for forcing said toggles in one direction, and a compound lever for forcing said toggles in an opposite direction arranged in the line of movement of said weight, substantially as set forth.

10. In an elevator, the combination, with the power-controlling shaft having a drum thereon, of the pivoted brake-shoes H, having elongated arms arranged to impinge said drum, toggles connecting said arms, the fixed bracket L, the telescopic pin or shaft having one end secured to said bracket and its other end to said toggles, a spring sleeved on said

telescopic shaft for forcing said brake-shoes into engagement, and means for disengaging said brake-shoes, substantially as set forth.

11. In an elevator, the combination, with the elevator-shaft having doors, of a weight connected with said doors for closing them, an antifriction-roller on said weight, means for preventing the rotation of said weight, a brake for preventing the movement of the elevator-car, and a lever for disengaging said brake and arranged to be impinged by said antifriction-roller, substantially as set forth.

12. In an elevator, the combination, with a weight for closing the doors and a brake for preventing the movement of the elevator-car, of a pivoted lever O for disengaging said brake, the standard *t*, through which said lever passes, the lever T′, pivoted in said standard *t* and resting upon the end of the lever O and being arranged in the line of movement of said weight, and a guide for said lever T′, substantially as set forth.

13. In an elevator, the combination, with the elevator-shaft having doors, of a weighted cable suspended in said shaft, antifriction devices arranged between said cable and door, and a pulley secured to the door and adapted to engage the cable between said antifriction devices, substantially as set forth.

14. In an elevator, the combination, with the elevator-shaft having a door, of a weighted cable suspended in said shaft, antifriction-rollers journaled one above the other between said cable and door, a bracket or lug on said door projecting between said antifriction-rollers, and a pulley on said bracket or lug adapted to engage said cable, substantially as set forth.

WALTER J. ROCHIFORD.
ERNEST W. KEMPTER.

Witnesses:
R. C. OMOHUNDRO,
F. A. HOPKINS.

(No Model.)

F. E. HERDMAN.

ELEVATOR.

No. 487,268. Patented Dec. 6, 1892.

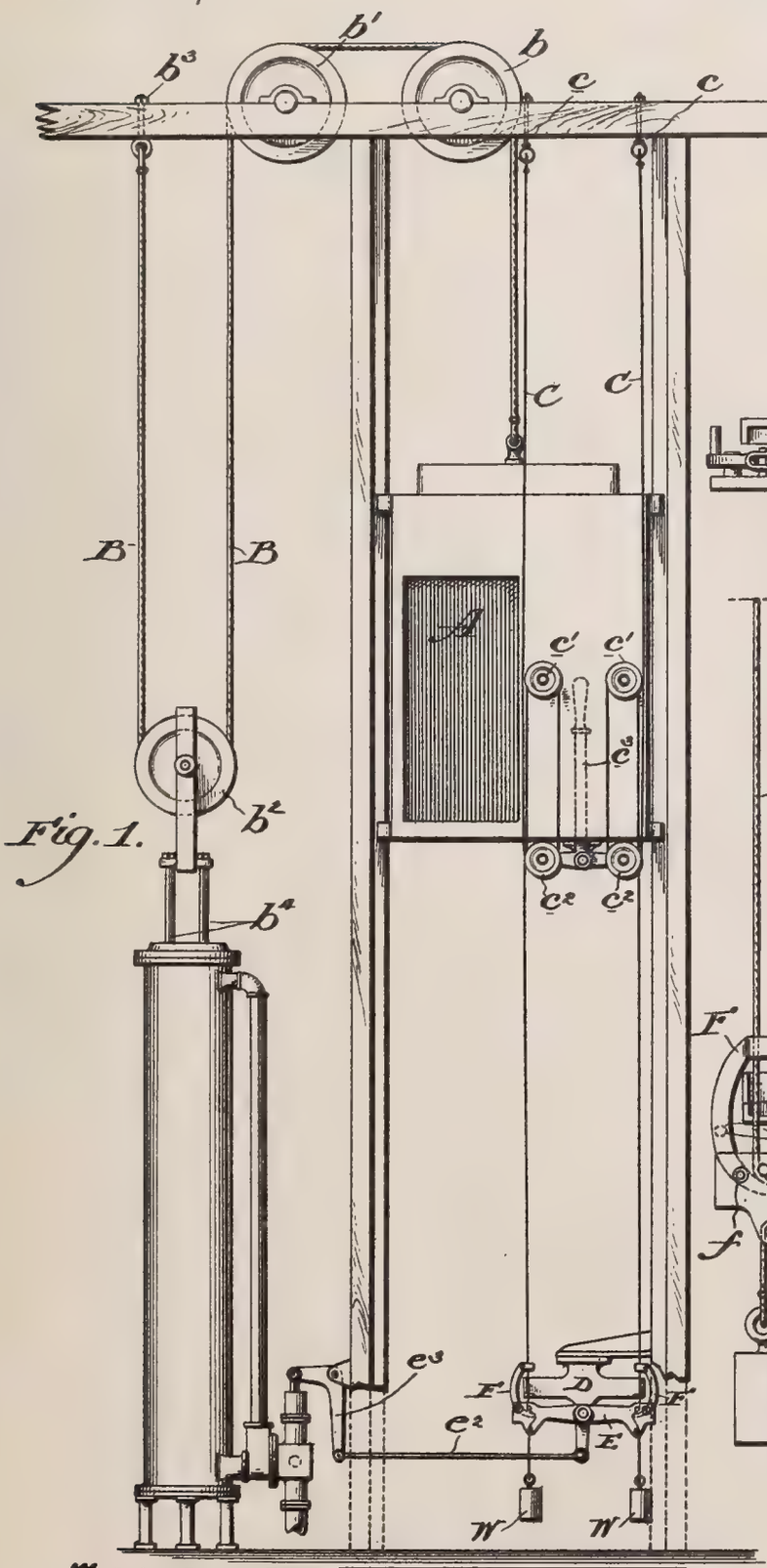


Fig. 1.

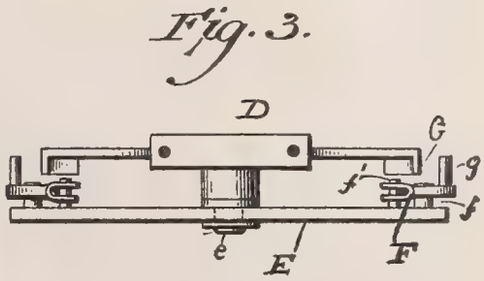


Fig. 3.

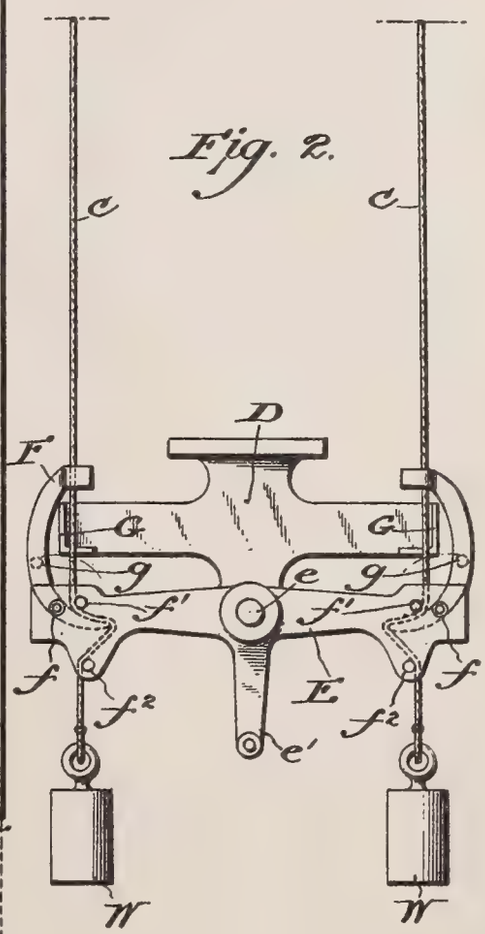


Fig. 2.

WITNESSES:
David S. Williams
Frank S Bussau

INVENTOR:
Frank E. Herdman
by his atty
G. H. Hamilton

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

48714.63

UNITED STATES PATENT OFFICE.

FRANK E. HERDMAN, OF INDIANAPOLIS, INDIANA.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 487,268, dated December 6, 1892.

Application filed July 19, 1892. Serial No. 440,456. (No model.)

To all whom it may concern:

Be it known that I, FRANK E. HERDMAN, a citizen of the United States, residing at Indianapolis, county of Marion, and State of Indiana, have invented a new and useful Improvement in Elevators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention has for its object an arrangement, whereby if one of the operating-cables should break the car can still be operated by the other cable and brought to any point in its travel desired by the operator; and it consists in certain construction of mechanism whereby this result is obtained.

In the drawings, Figure 1 is a side elevation. Fig. 2 is a detached side elevation of part of mechanism. Fig. 3 is a detached plan view of the same.

A is the elevator-car; B, the lifting-cable, which is connected to the car and passes over the pulleys b b' and around the traveling sheave b^2 and is connected to a fixed support at b^3. The sheave b^2 is connected to the piston b^4, which operates by hydraulic power in the ordinary manner.

C are the operating-cables, which are connected at the top to the beam at c c and pass through the car, passing around the pulleys c' c' c^2 c^2, which are operated by the lever c^3. To the end of each cable is attached a weight W.

D is a bracket to which is attached the lever E, pivoted to said bracket at e and having the dependent portion e', to which is connected the rod e^2, connected to the bell-crank e^3, which in turn is connected to the operating-valve. To each end of the lever E is attached a bent lever F, pivoted to said lever at f. At each end of the lever E are also the pins f' f^2. One end of each of the levers F is grooved and the cables C C pass through said grooves and around the pins f' f^2 and around the end of levers F (see Fig. 2) when the cable is taut, as in normal operation of elevation, and the operating-lever c^3 in position shown in Fig. 1. The lower ends of levers F are in such position as to bend the cables around the pins f' f^2, and in consequence a movement of lever c^3 will tip lever E the same as if it were fixedly fastened on the end of lever E, and the weights w w balance each other. If either cable C should break, the rope on that side becomes slack and the lever F on that side drops inwardly, which loosens the cable around the pins f' f^2, thereby relieving the weight W on that side, and it falls. The weight on the unbroken cable is now able to draw that end of the lever down and the operator can operate the unbroken cable upward, thereby allowing the car to be operated, although one cable be broken. As the weight of the unbroken cable tends to draw that end of the lever down, and in consequence if the lever is thrown in position on the car to be at rest, this weight would tend to operate the car in the other direction. To prevent this, the bracket D, to which the lever E is attached, can have a projection G at each end and the levers F a pin g. Now in case the cable at the left side should break when the lever E is above the center the pin g would rest against the projection G and prevent the lever F from dropping inward until the lever E has been brought to the center by the starting of the cable attached to the right hand of lever E. As soon as the lever E has been brought to the center then the pin g will be below the projection G, and in consequence the lever F would drop inward, loosening the cable and allowing the weight W to drop. By this arrangement the weight W on the right-hand lever F could not tip lever E from the central position, and in consequence there would be no danger of the weight reversing, as it could only bring it to a central position.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. In an elevating apparatus, the combination of the operating-cables, means for exerting a downward strain upon each of said cables, a pivoted lever E, pins upon said lever, around which said cables pass, levers F at each end of said lever E, around the ends of which lever F the cables pass, and intermedial mechanism between the operating-cables and the operating mechanism.

2. In an elevating apparatus, the combination of the operating-cables, means for ex-

erting a downward strain upon each of said cables, a lever, as E, a bracket, as D, to which said lever is pivoted, projections upon said bracket, pins upon said lever, around which said cables pass, levers F at each end of said lever E, around the ends of which levers F said cables pass, and pins upon said levers in line with the projections upon the bracket.

3. In an elevating apparatus, in combination, the operating-cables, valve-operating lever, means for exerting downward and normally-counterbalancing strains upon said cables and lever, and means, substantially as described, when the cable in action breaks to retain the counterbalancing strain upon the corresponding side of said lever until said lever is brought to the center and to retain the said strain upon the lever when the lever attains its central position.

4. In an elevating apparatus, in combination, the operating-cables, valve-operating lever, means for exerting downward and normally-counterbalancing strains upon said cables and lever, and means, substantially as described, when the cable in action breaks to retain the counterbalancing strain upon a portion of the broken cable and the corresponding side of said lever until the lever is brought to its central position and to relieve the said strain upon the portion of the broken cable and upon the lever when said central position is attained.

In testimony of which invention I have hereunto set my hand.

FRANK E. HERDMAN.

Witnesses:

W. L. ROBINSON,

W. V. MARTIN.

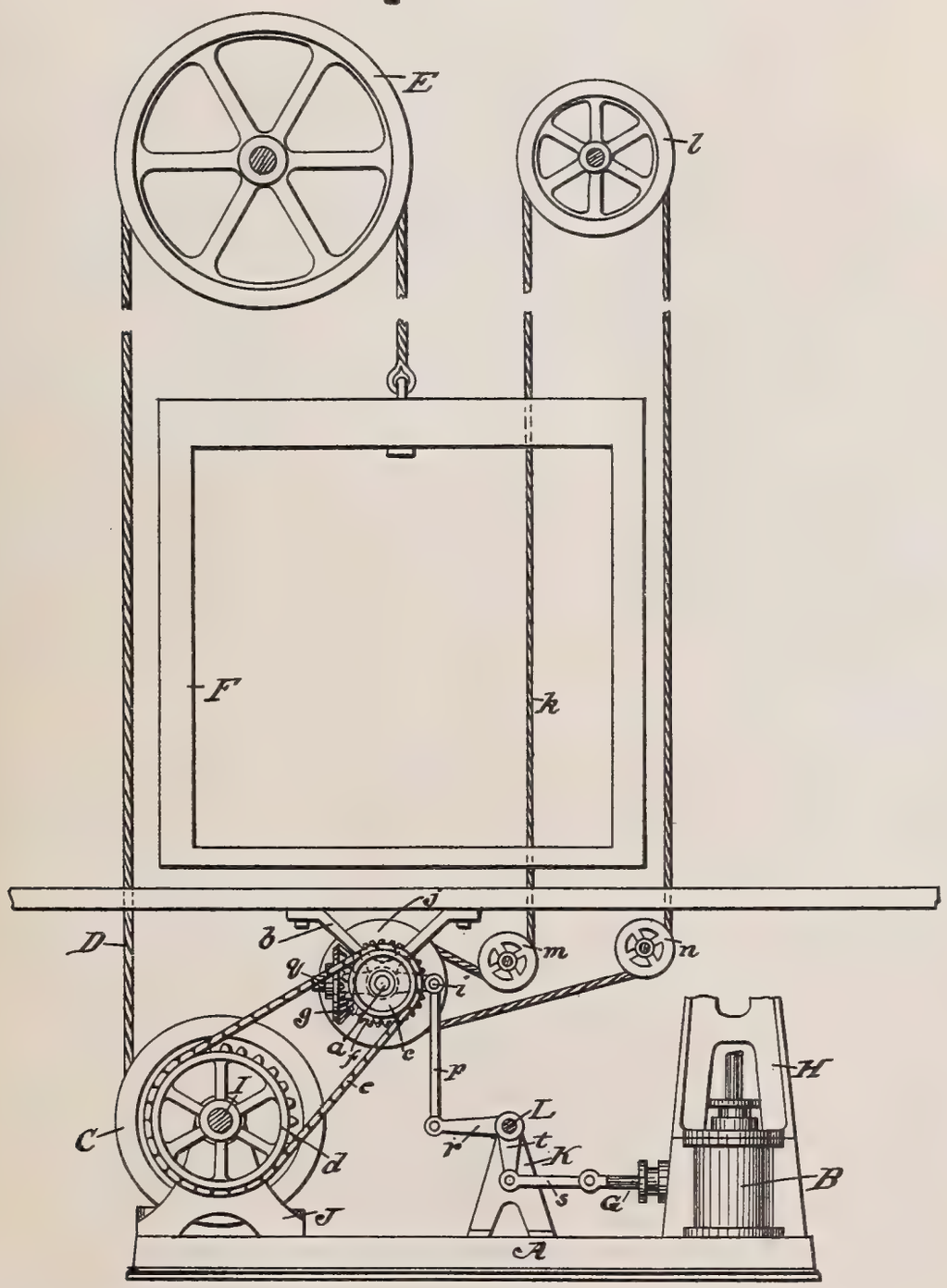
(No Model.) 2 Sheets—Sheet 1.

C. E. MOORE.

OPERATING MECHANISM FOR ELEVATORS.

No. 488,526. Patented Dec. 20, 1892.

Fig. 1



WITNESSES:
Rodney W. Grundish
Joseph H. Moore.

INVENTOR
Charles E. Moore

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

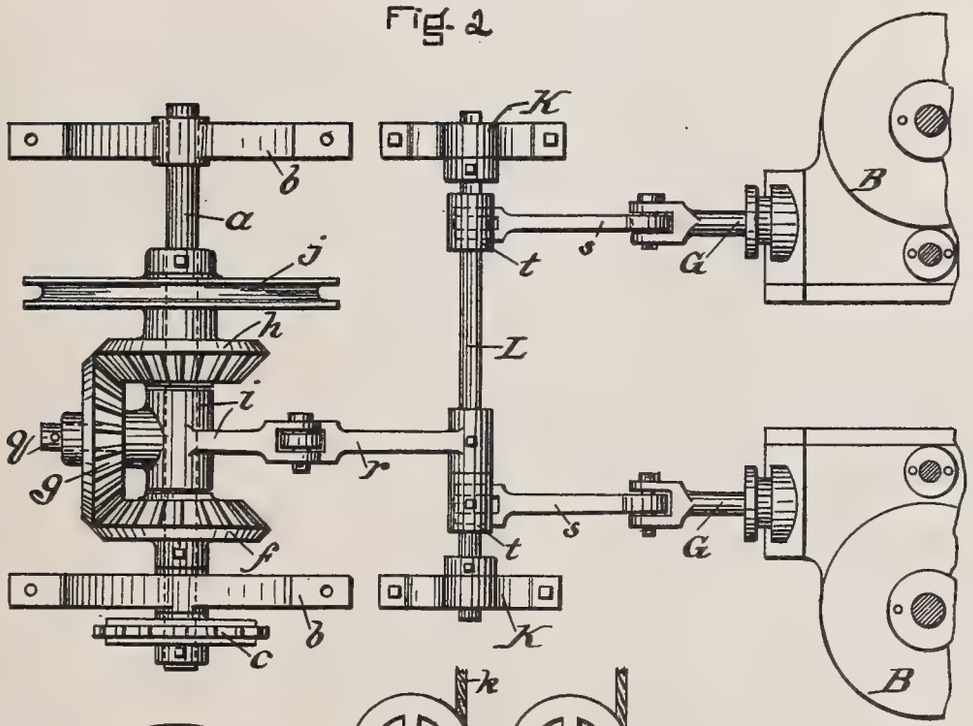
(No Model.) 2 Sheets—Sheet 2.

C. E. MOORE.

OPERATING MECHANISM FOR ELEVATORS.

No. 488,526. Patented Dec. 20, 1892.

Fig. 2.



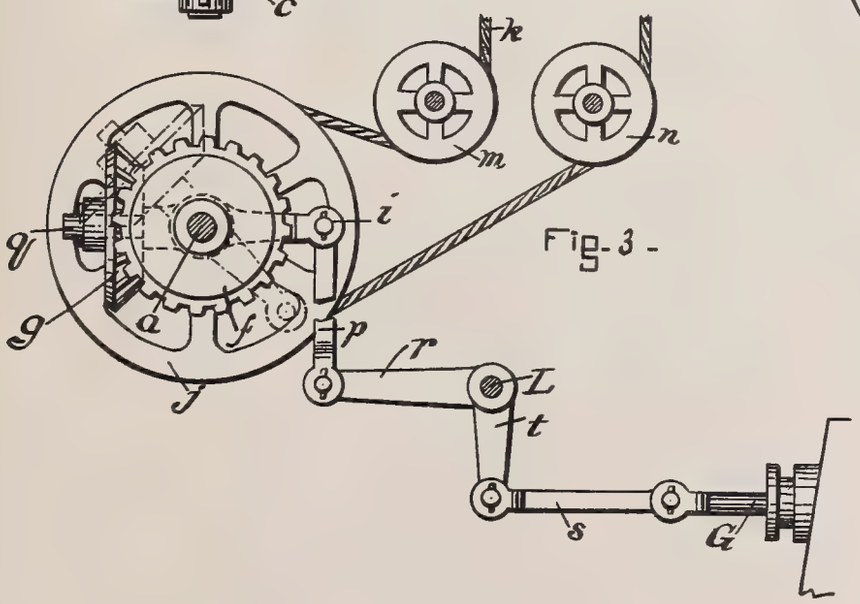


Fig. 3.

WITNESSES:
Rodney W. Greenleaf
Joseph H. Moore.

INVENTOR
Charles E. Moore

THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES E. MOORE, OF BOSTON, MASSACHUSETTS.

OPERATING MECHANISM FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 488,526, dated December 20, 1892.

Application filed July 5, 1892. Serial No. 438,886. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. MOORE, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Operating Mechanism for Elevators, of which the following is a full description, reference being had to the accompanying drawings, making part of this specification, embodying my invention.

My invention relates to a device whereby the car of an elevator and the operating rope will both move at the same speed and in the same direction whenever the elevator is in motion; the operating rope not being attached to the car, but deriving its motion from differential mechanism, the said mechanism being driven from the drum-shaft, or from any of the other moving parts of the motor which drives the elevator. With the usual arrangement of the operating rope and its connections with the operating mechanism, the rope will remain at rest while the car is in motion and it is necessary, in order to stop the elevator, that the attendant grasp and hold the rope; and the time in which the elevator is stopped depends upon the speed at which the car may be moving, and with fast running elevators, this is a serious objection, as it causes a dangerous and disagreeable shock to the car, serious water hammer in hydraulic elevators, and also, carrying the operating mechanism beyond the stopping point and starting the elevator in the opposite direction.

With my improvement, the operating rope moves with the car, at the same speed and in the same direction; and the elevator can be stopped in any desired time independently of the speed at which the car may be moving.

The drawings represent my invention in connection with the operating valves of a steam elevator, only such parts of the elevator being shown as are connected with my improvement.

Figure 1 is a side elevation of an elevator having my improved operating mechanism applied thereto. Fig. 2 is a plan and Fig. 3 a side view of the differential mechanism.

A is the bed-plate of a steam elevator, B the cylinders, C the hoisting-drum, carrying the hoisting rope D, which passes over the wheel E and is connected to the car F.

G are the operating-valve-stems, H the engine frame, I the drum-shaft, J the drum-shaft-stand, and K the stands of the rocker-shaft L.

All the parts above designated are common to all steam elevators and form no part of my invention.

The following designated parts relate to my invention and are shown on Sheets 1 and 2.

(*a*) is a shaft supported by the hangers (*b*), (*c*) a sprocket-wheel tight on shaft (*a*), (*d*) a sprocket-wheel tight on the end of drum-shaft I; the sprocket-wheels being connected by the link-belt (*e*).

(*f*), (*g*), and (*h*) are three miter gears, (*f*) being tight on shaft (*a*), (*g*) turning loose at the end of the forked lever (*i*), which lever, is loose on shaft (*a*), and (*h*) is also loose on shaft (*a*). Fastened to the hub of the gear (*h*) is a grooved wheel (*j*) which carries the operating rope (*k*), the said rope passing through the car, over the wheel (*l*) and down on the outside of the car around the wheel (*j*) guided by the leader wheels (*m*) and (*n*). To one end of the lever (*i*) is connected the rod (*p*) and at the opposite end is the gear (*g*) turning on the stud (*q*). The rod (*p*) connects with the lever (*r*), and the rod (*s*) with the valve-stems G and levers (*t*).

The operation of the above described mechanism is as follows:—The elevator being at rest with the car at the bottom of the hoistway, the operator in the car gives a downward pull to the operating rope (*k*) which turns the wheel (*j*) and gear (*h*), they being loose on the shaft (*a*); and as the shaft (*a*) can only turn when the elevator is in motion, the gear (*h*) will turn the gear (*g*) and move it around the gear (*f*) and carrying the lever (*i*) to the position shown by the dotted lines in Fig. 2, Sheet 2; and by the connections with the operating valve-stems G by the rods (*s*) and (*p*), levers (*r*) and (*t*), the valves are opened and the elevator started. Immediately when the elevator starts, the shaft (*a*) which drives the differential gearing will be set in motion, being driven from the drum-shaft of the elevator by the link-belt (*e*), and will turn the wheel

(*j*) by the gears (*f*), (*g*) and (*h*) driving the operating rope (*k*) at the same speed and in the same direction that the car is moving. Pulling the operating rope in the opposite direction closes the valves and stops the elevator.

What I claim as my invention and desire to secure by Letters Patent, is:—

The combination, with an elevator car and its hoisting and starting and stopping mechanism, of the shaft *a*, connected with and driven by the hoisting mechanism, the wheel *j* turning on said shaft *a*, the operating rope *k* traveling at the same speed and in the same direction as the car, said rope passing over said wheel *j* and a wheel *l* at the top of the hoistway, and the differential mechanism for transmitting motion from the wheel *j* to the starting and stopping mechanism and from the shaft *a* to the operating rope wheel *j*, said differential mechanism consisting of the miter gear *h* turning loosely on said shaft *a* and having the wheel *j* immovably secured to its hub, the lever *i* connected at one end with the starting and stopping mechanism, a miter gear *f* immovably secured to the shaft *a*, and the miter gear *g* turning loosely on the end of the lever *i* and meshing with both of the gears *h* and *f*, all operating substantially in the manner and for the purpose set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 2d day of July, A. D. 1892.

CHARLES E. MOORE.

Witnesses:
RODNEY W. GREENLEAF,
JOSEPH W. MOORE.

(No Model.)

A. T. CHASE.

ELECTRIC ELEVATOR.

No. 508,680. Patented Nov. 14, 1893.

FIG. 1.

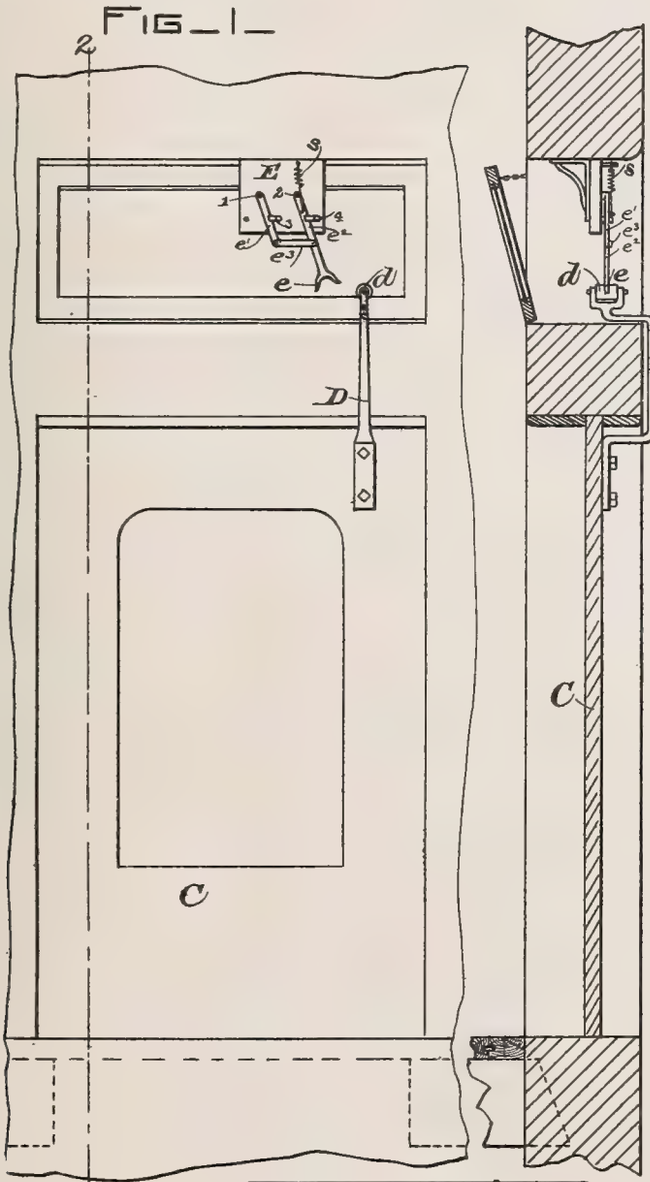


FIG. 2.

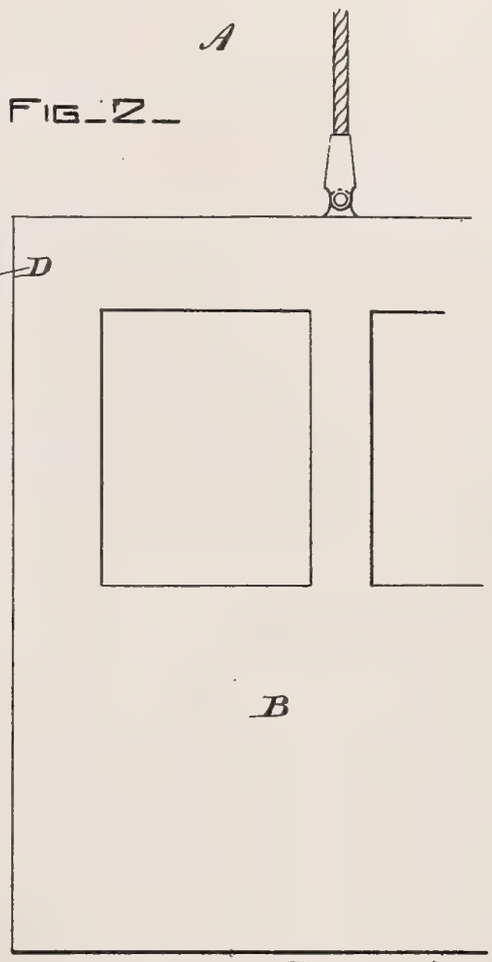


FIG. 3.

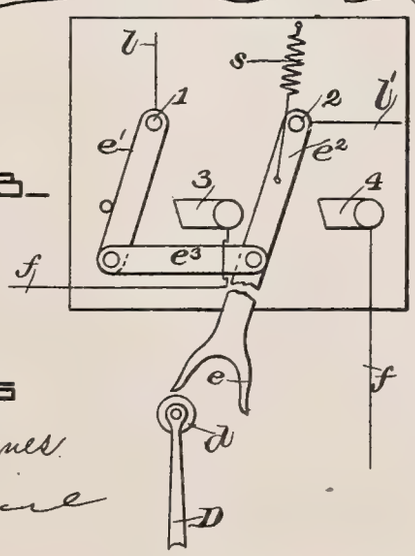
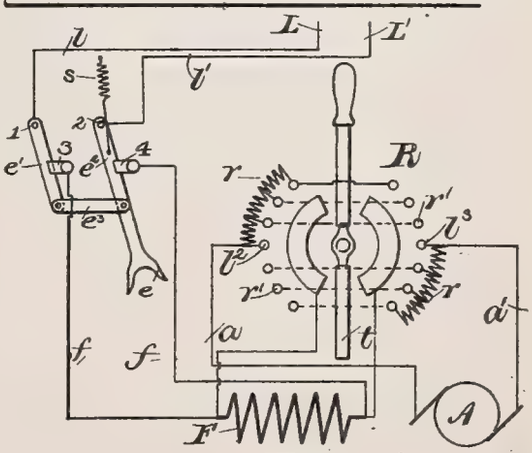


FIG. 4.



WITNESSES

C. L. Haynes

A. D. Shine

INVENTOR

Arthur Taft Chase

by Bentley & Blodgett

Attys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

U. TED STATES PATENT OFFICE.

ARTHUR T CHASE, OF CAMBRIDGE, MASSACHUSETTS, ASSIGNOR TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF CONNECTICUT.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 508,680, dated November 14, 1893.

Application filed December 16, 1891. Serial No. 415,223. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR TAFT CHASE, a citizen of the United States, residing at Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Electric Elevators, of which the following is a specification.

This invention relates to improvements in circuit controlling devices for electric elevators, the object of the invention being to break the circuit through the field magnet, at times when the elevator is not at work for a considerable period, so as to economize the current used.

As is well known there are times, frequently of considerable duration, during which an elevator is not at work, the elevator cab being at such times, usually at the bottom of the hatchway. In the case of electric elevators when the current is kept turned on through the field magnet during such times, a considerable waste of electric energy occurs. To obviate this waste, I take advantage of the above mentioned fact that when the elevator is not running the cab is usually at the bottom of the shaft, with its door and the door into the hatchway at that point open. On one of these doors, for example, the hatchway door, I place a projection or striker, which when the door is opened engages with a switch connected to the field magnet circuit of the elevator operating motor, so as to cause such circuit to be opened and cut off the current from the field magnet. When the door is closed a reverse motion of the switch is effected, again energizing the field magnet and putting the motor in operative condition.

In the accompanying drawings, Figure 1 is an elevation of a portion of the lower part of the hatchway, showing the door, the striker thereon and the switch operated thereby. Fig. 2 is a vertical section on the line 2—2 in Fig. 1, also showing a portion of the cab. Fig. 3 is an enlarged view of the switch in the open position. Fig. 4 is a diagram of the circuit connections.

A represents a part of the elevator shaft, B the cab and C an elevator door on the lower or ground floor. An arm or projection D attached to this door extends upwardly and carries an anti-friction roller *d*, which, when the door is moved in one direction or the other, engages with the forked end *e* of an arm of a double-pole switch E, which is placed in or near the hatchway, and controls the circuit of the field magnet of the elevator operating motor.

As shown in Fig. 3 the switch may consist of two metal arms e', e^2 pivoted at 1 and 2 respectively, connected by an insulating link e^3 so as to have a parallel motion, and engaging with contacts 3, 4. The line connections l, l' from the constant potential circuit are brought to pivots 1 and 2, and the field magnet or motor connections f, f, lead from contacts 3, 4. When the elevator door is closed, as shown in Fig. 1, the switch levers e', e^2 engage with the contacts 3, 4, closing the field magnet or motor circuit, and the roller *d* stands somewhat to the right of the fork *e* formed on the end of the switch lever e^2. Now when the door is opened by sliding it to the left, the roller *d* strikes an arm of the fork *e* and throws the switch to the position of Fig. 3, and then passes on to the end of its travel. When the door is again closed, the roller returning, strikes the other end or arm of the fork, and carries the switch back. In order to insure this operation, to provide a quick break, and to hold the fork in its extreme position on either side so as to engage properly with the roller, I provide a double-throw spring *s* which may be attached at one end to a fixed support and at the other end to the lever e^2 so as to tend to hold the switch levers at either of their extreme positions, and to quickly bring them to such positions as soon as they have once passed the central position.

As before stated this invention is especially adapted for use with a constant potential circuit, the leads L, L′ of which are indicated in Fig. 4, connections l, l' being taken through the switch E and connections *f* to the field magnet F.

In derivation with the field magnet circuit is the armature circuit a, a' including the armature A of the elevator operating motor, and a controlling rheostat and circuit breaker

R having resistances r a series of contacts r' therefor, line terminals l^2, l^3, and a controlling switch lever t, which co-operating with the line and resistance contacts, serve to make, break, reverse and vary the resistance of the armature circuit. Any other approved form of controller for the armature circuit of the motor may however, be adopted in place of that here shown.

My invention relates more particularly to the combination with an armature circuit having a controlling means therein, of a derived field magnet circuit having connections to the line independent of the circuit controller in the armature circuit, but controlled by an independent switch which may be left closed during such ordinary reversals and stoppages as occur while the elevator is running up or down the shaft, and may be opened at times when the elevator is stopped for such a period as to make it desirable to save the waste of current through the field magnet. The circuit breaker controlling the field magnet connections may obviously be operated in other ways so as to obtain the above result. For example, the striker D may be attached to either the hatchway door, as shown, or to the cab door, or to any other movable part within reach of the elevator attendant when the cab is in a position at which a long stop is likely to be made.

It is desirable to make the circuit breaking switch e', e^2 open the connections of both the field magnet and the armature circuits, so as to prevent the possibility of the current being turned onto the armature while the field magnet is inactive. I therefore prefer to derive the armature and field circuits from common connections controlled by this switch as shown at f, f, in Fig. 4.

What I claim as new, and desire to secure by Letters Patent, is—

1. In an electric elevator, the combination with the cab carrying a controlling device for the armature circuit, of a double pole switch controlling the line connections to the field magnet and armature and located near the elevator shaft, and a door giving access to said shaft and having an arm to positively open said switch when the door is opened, and vice versa, substantially as described.

2. In an electric elevator, the combination with the cab B, of the armature controlling device mounted in the cab, the shunt wound motor, the spring actuated double pole switch controlling the connections from the mains to the motor, and having a fork e, and the elevator shaft door C, carrying an arm D adapted to strike and operate the fork e both in the opening and closing of the door, substantially as described.

In witness whereof I have hereunto set my hand this 11th day of December, 1891.

ARTHUR TAFT CHASE.

Witnesses:
A. P. KNIGHT,
C. L. HAYNES.

(No Model.)

R. W. MAGRANE.

ELECTRIC SAFETY DEVICE FOR ELEVATORS.

No. 513,122. Patented Jan. 23, 1894.

Fig. 1.

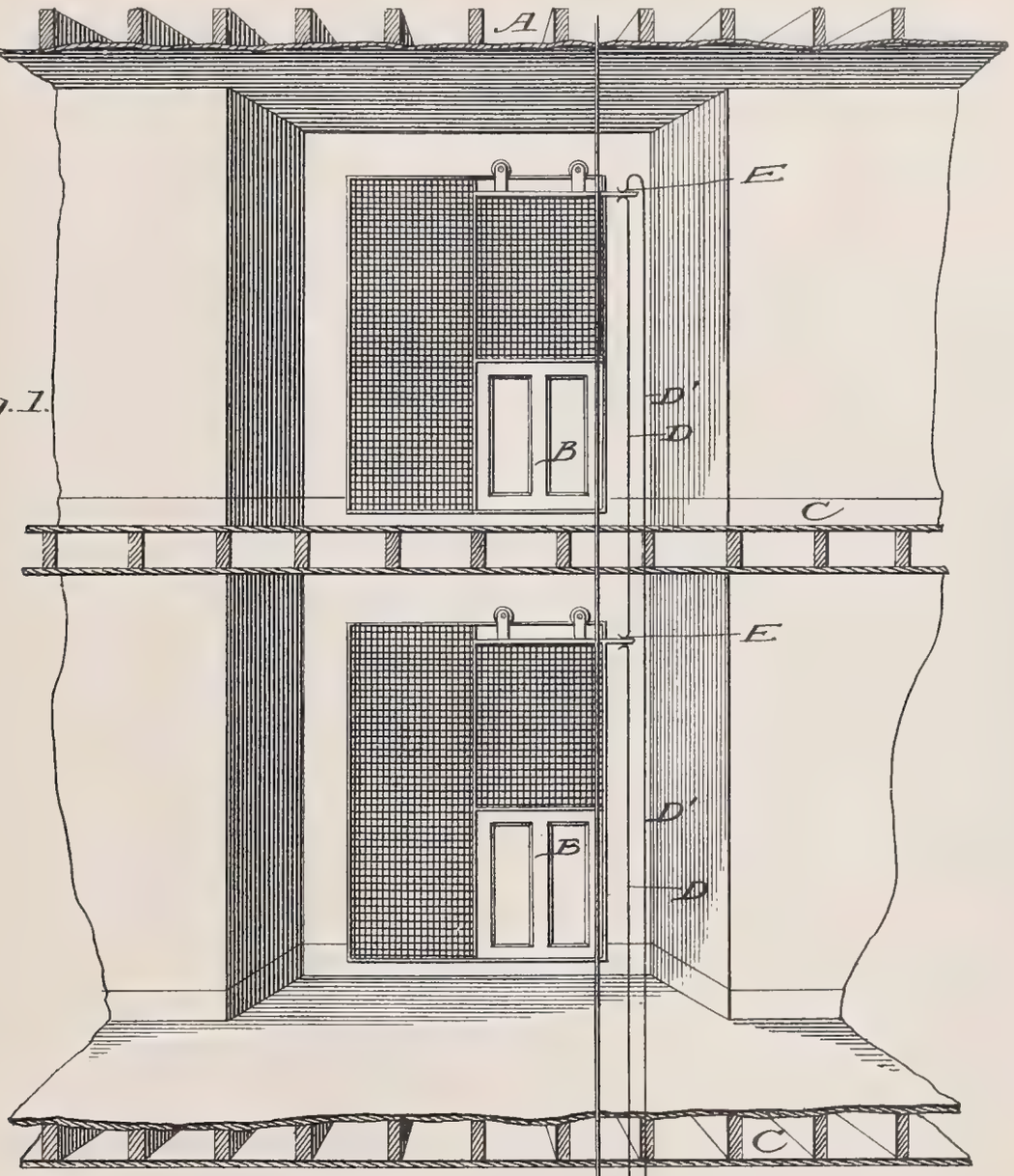
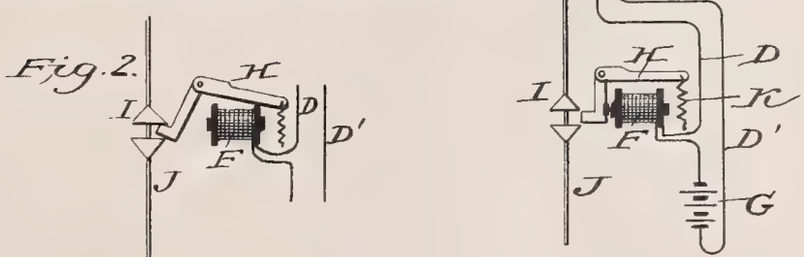


Fig. 2.



Witnesses.

J. J. Fredricks.

A. J. Oesterla.

Inventor

R. W. Magrane.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ROBERT W. MAGRANE, OF BROOKLYN, NEW YORK.

ELECTRIC SAFETY DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 513,122, dated January 23, 1894.

Application filed March 17, 1892. Serial No. 425,351. (No model.)

To all whom it may concern:

Be it known that I, ROBERT W. MAGRANE, a citizen of the United States of America, and a resident of the city of Brooklyn, State of New York, have invented a new and useful Improvement in Electric Safety Devices for Elevators, of which the following is a specification.

My invention relates to safety devices for passenger and freight elevators in buildings, so that the elevator cannot be started either way until all the doors or openings have been closed, and has for its object the provision of a device simple in construction, cheap in manufacture, and efficient in practical use.

To attain the desired end, my invention consists in the construction and arrangement of parts hereinafter fully set forth and described.

Accidents are of frequent occurrence in buildings, caused by elevator doors being left open, and people unconsciously walking through same, or the car being started either through inexperience, or carelessness catching people between the car and floor, or ceiling, causing severe injuries, and in most cases instant death.

Referring to the drawings which form part of this specification:—Figure 1, represents a complete view of my invention in elevation, showing all the doors B, closed and the armature-lever H, of magnet F, attracted and free from the clutch I, on check rope J. Fig. 2, is a detail view showing the armature-lever H, of magnet F, released preventing the check rope J, from being moved.

Referring again to the drawings:—A, represents an elevator shaft, B doors, C floors, D D′ electric circuit, E projections on doors to open or close circuit, F magnet, G battery, H armature-lever, I clamp or tapered obstruction (for convenience shown on check rope), J check rope, K retractile spring. It is evident that when all the doors are closed as shown in Fig. 1, the armature-lever H, will be attracted leaving the check or controlling rope J, and the clamp, or tapered obstruction I, free for manipulation either way. For convenience a projecting tapered obstruction is shown. In both figures the check, or controlling rope J, is shown in its position when the elevator car is at rest, and in which position the tapered stop is adapted to be engaged by the armature-lever H, when the magnet F, is de-energized as shown in Fig. 2 and thereby lock the check rope J. When the car is started by the operator the movement of the rope J carries the tapered stop above or below its normal position opposite the lever H, according to the direction in which the car is to be moved, and in either of which positions the lever H, cannot engage the tapered stop to lock the rope J. If the circuit D D′ be broken by the door being opened, the spring K, will force the lever H, into the path of the stop, but the lever cannot engage the stop until the elevator is arrested. In stopping the car the movement of the rope J, causes the tapering obstruction I, to engage the lever H, and force it aside until the obstruction is in the position shown in Fig. 2, when the spring K, will cause the lever H, to positively engage the said obstruction and thereby lock the operating rope.

As it is evident that many slight changes in the construction and relative arrangement of parts might be resorted to, without departing from the spirit and scope of my invention, I would have it understood that I do not restrict myself to the particular construction and arrangement of parts shown and described, but that I reserve the right to make such changes, and that

What I claim as new, and desire to secure by Letters Patent, is—

1. In an elevator, the combination of an elevator door, and the valve rope provided with a tapered stop; an electro magnetic device adapted to engage said stop when the door is open, an electric circuit in which the magnet of said device is located, and a make and break contact for the electric circuit, controlled by the opening and closing of the door, substantially as shown and described.

2. In an elevator, the combination of the valve rope, provided with a tapered stop, the elevator door, an electro-magnetic device adapted to engage said stop on the valve rope, when the door is open, an electric circuit controlled by the opening and closing of the door, in which the magnet of said device is located, substantially as shown and described.

3. In an elevator, the combination of an elevator door, an electric circuit controlled by the opening and closing of the door; an electro-magnetic locking device with its actuating magnet located in said circuit, the valve rope provided with a tapered stop which is adapted to be engaged by the bolt or lever of said locking device when the circuit is opened by the door, arresting movement of valve rope to start elevator, and also permitting free movement of valve rope to its neutral position, when elevator is under headway, substantially as shown and described.

4. In an elevator, the combination, with an elevator door adapted to be operated by hand, and a valve rope provided with a tapered stop, of a safety device and means whereby the safety device may be thrown into position to engage said tapered stop by the opening of the door, substantially as shown and described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 9th day of March, 1892.

ROBT. W. MAGRANE.

Witnesses:
JOHN P. REGAN,
JOSEPH WEBER.

(No Model.)

A. N. CALKINS.

ELEVATOR CONTROLLING DEVICE.

No. 523,197. Patented July 17, 1894.

Fig. 1.

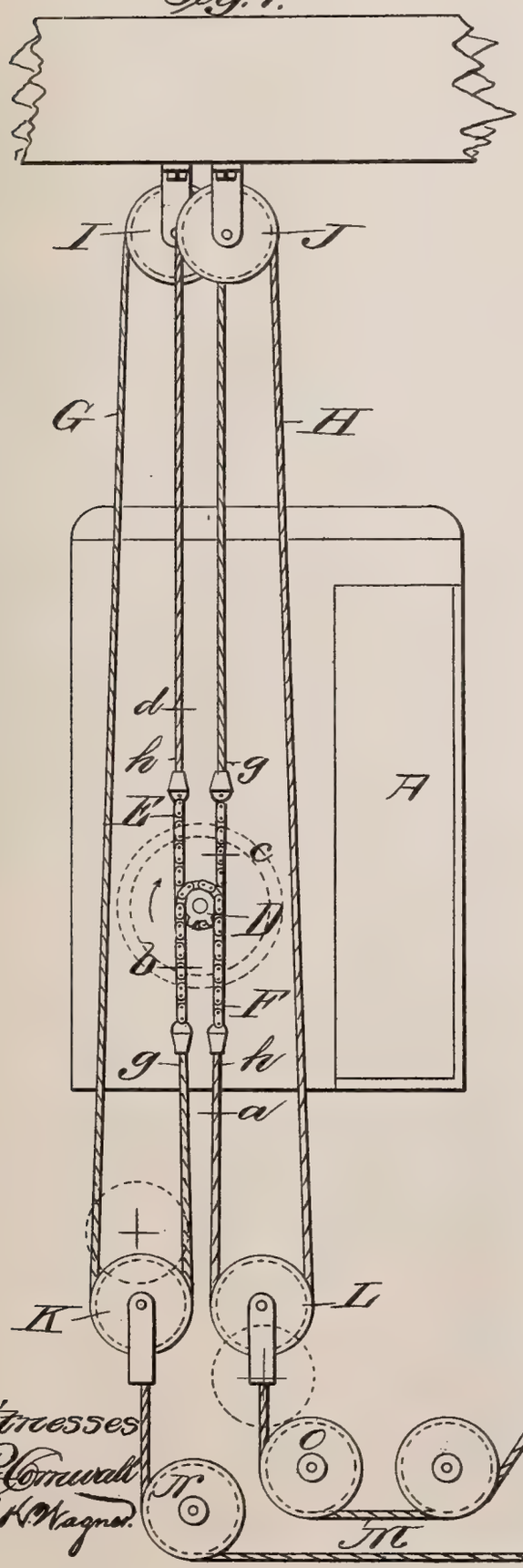
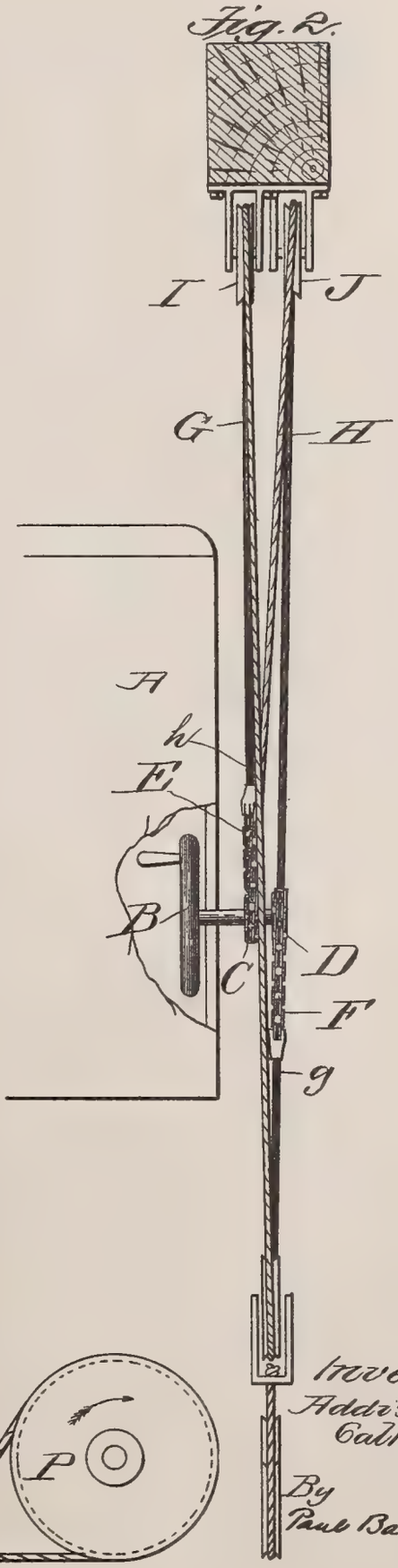


Fig. 2.



Witnesses
J. P. Cornwall
Hugh L. Wagner.

Inventor,
Addison N. Calkins
By
Paul Bakewell
Atty

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

Corrections in Letters Patent No. 523,197.

It is hereby certified that in Letters Patent No. 523,197, granted July 17, 1894, upon the application of Addison N. Calkins, of Quincy, Illinois, for an improvement in "Elevator Controlling Devices," errors appear in the printed specification requiring correction, as follows: In line 22, page 2, a comma should be inserted after the word "cables," and same line, same page, the comma after the word "mounted" should be stricken out; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 31st day of July, A. D. 1894.

[SEAL.]

WM. H. SIMS,
First Assistant Secretary of the Interior.

Countersigned:
JOHN S. SEYMOUR,
Commissioner of Patents.

UNITED STATES PATENT OFFICE.

ADDISON N. CALKINS, OF QUINCY, ILLINOIS, ASSIGNOR TO THE CENTRAL MACHINE AND FOUNDRY COMPANY, OF SAME PLACE.

ELEVATOR CONTROLLING DEVICE.

SPECIFICATION forming part of Letters Patent No. 523,197, dated July 17, 1894.

Application filed November 9, 1893. Serial No. 490,449. (No model.)

To all whom it may concern:

Be it known that I, ADDISON N. CALKINS, a citizen of the United States, residing at Quincy, Adams county, State of Illinois, have invented a new and useful Elevator Controlling Device, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, wherein like letters of reference refer to like parts wherever they appear, and in which—

Figure 1 is a diagrammatical view, in side elevation, showing the operation of my new controlling device. Fig. 2 is a similar view at right angles.

My invention relates to a new and useful improvement in devices for controlling the motive power of elevator machinery, and consists, generally stated, in combining with the elevator car, two wheels, around which pass cables, which cables pass around pulleys or sheaves located above and below the travel of the car, and are paid out or drawn in on each side of the wheels on the car when the same are rotated, to operate a controlling rope which is secured to movable pulleys or sheaves actuated by the cables.

In the drawings, A represents the elevator car, in which is mounted a suitable operating hand-wheel or lever B whose shaft projects through the side of the car and is provided with two sprocket wheels C and D. Passing over these sprocket wheels, are short sections of chain E and F, to the ends of which are connected the ends of the cables G and H, which pass over sheaves I and J, respectively, at the top of the shaft, and under movable sheaves K and L at the bottom of the shaft, or vice versa, as the case may be.

The sheaves K and L are mounted in suitable bearings attached to the ends of a controlling rope or cord M, which passes under suitable stationarily mounted sheaves N and O and around the controlling wheel or pulley P, which operates a valve rheostat or belt shifter directly controlling the machinery or motive power of the elevator.

The cables G and H have their ends *g* and *h*, connected, respectively, to the chains E and F, in such manner that when the sprocket-wheels C and D are caused to rotate and the chains E and F pass under and over or from one side to the other of said sprockets, the ends of the cables G and H will be drawn toward or away from each other, dependent upon the rotation of the sprocket wheel, which will shorten one of said cables and lengthen the other, as the case may be, and raise or lower the sheaves K and L, which will disturb the equilibrium of rope M rotating the wheel or pulley P in one direction or the other to start, stop, or effect the shift of the elevator power machinery.

The operation is as follows:—Assuming the parts to be in their normal position, in Fig. 1, or a position in which the machinery is at rest, and assuming that to effect the rise of the elevator car the wheel P is to be turned to the right, or in a direction as indicated by the arrow, the operator turns the wheel B or lever, as the case may be, in the direction indicated by the arrow in Fig. 1. This will cause the sprocket wheels C and D to be rotated to the right, forcing the right hand end of the chain F down to a point about line *a* and raising the left hand side of the chain to about a point indicated by the line *b;* at the same time, causing the chain E to pass under the sprocket wheel C, bringing the right hand end down to a point about *c* and raising the left hand end to a point about line *d*. As the cables G and H have their ends connected to the chains E and F on opposite sides of the sprocket C and D, respectively, when said sprocket wheels are caused to be rotated, as above indicated, one end *g* of the cable G will be brought down to about line *c*, while the other, the lower, connected to the chain F, will be raised to about line *b*. This shortening of cable G causes the sheave K to be raised, pulling rope M so as to revolve wheel P in the direction of the arrow. At the same time, the sheave L will be permitted to follow the rope M by the cable H which passes thereunder being lengthened by the chains E and F reaching lines *d* and *a*, respectively. To throw off the power, or cause the elevator car to stop, it is only necessary that the sprocket wheels C and D be returned to a position so as to equalize the cables and their sheaves K and L to which the controlling rope proper is attached, and, to reverse the motion of the car, or permit it to run down

the shaft, a continued movement of the sprocket wheels C and D in an opposite direction from that indicated will cause the sheave L to rise and K to be lowered.

It will be noted that the cables being secured to the chains, as above described, form substantially a continuous cable, which passes around two stationarily mounted pulleys located beyond one end of the travel of the car, around two movable pulleys located beyond the other end of the travel of the car, and around the wheels on the elevator car.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

The herein-described means for controlling elevator machinery, consisting in the combination with a car, of two sprocket wheels mounted thereon, means for operating said sprocket wheels, chains passing around said sprocket wheels and leading in opposite directions, two cables stationarily mounted, sheaves at the top of the shaft over which said cables pass, two movable sheaves at the bottom of the shaft under which said cables pass, said cables having their ends connected to the two chains on opposite sides of the sprockets, a controlling rope attached to the two movable sheaves at the bottom of the shaft, and means for rotating the sprockets from the car, whereby when the same is done, one cable is drawn in or shortened, thereby raising one of the movable pulleys, and the other cable is paid out or lengthened, thereby lowering the other pulley or sheave, substantially as described.

In testimony whereof I hereunto affix my signature, in presence of two witnesses, this 4th day of November, 1893.

ADDISON N. CALKINS.

Witnesses:
C. S. BURBIDGE,
JOSEPH KURZ.

(No Model.)

W. P. KIDDER.

SAFETY DEVICE FOR ELEVATORS.

No. 525,421. Patented Sept. 4, 1894.

Fig. 1.

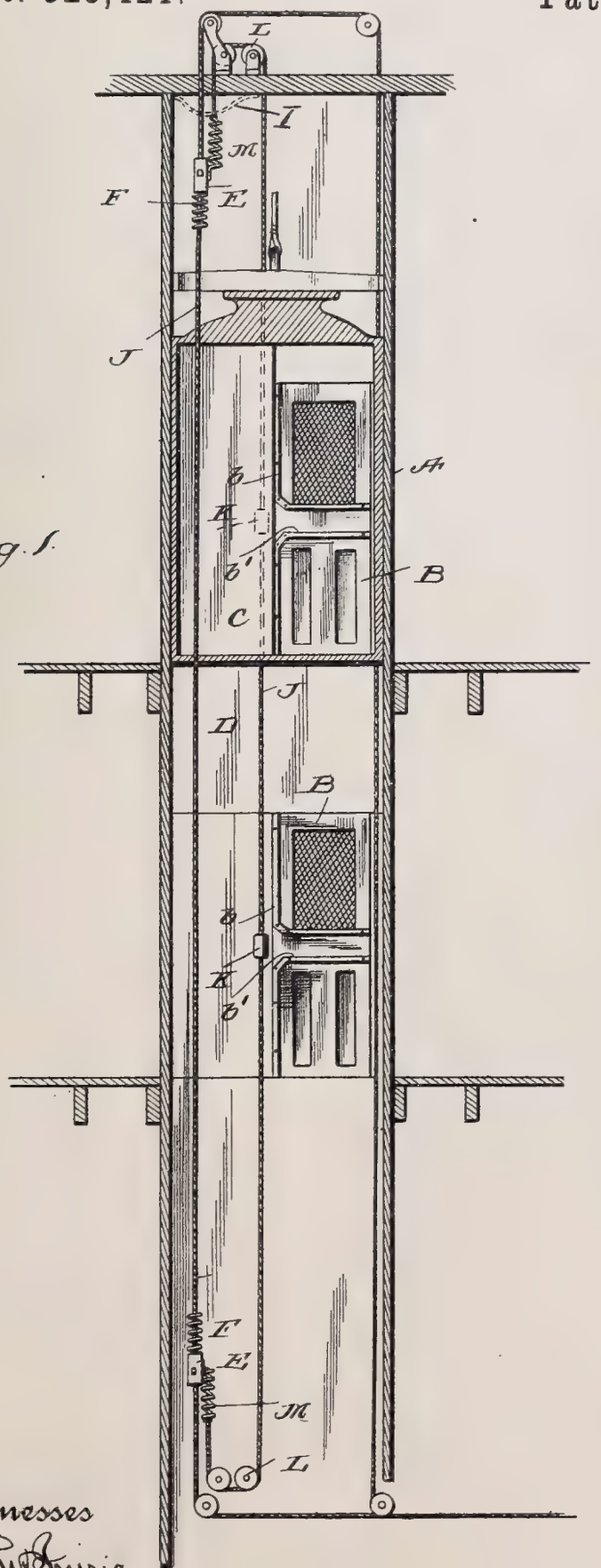


Fig. 2.

Witnesses
John Lawrie
H. E. Clendaniel.

Inventor
Wellington P. Kidder
By T. J. W. Robertson
Attorney

525.42

UNITED STATES PATENT OFFICE.

WELLINGTON P. KIDDER, OF BOSTON, MASSACHUSETTS.

SAFETY DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 525,421, dated September 4, 1894.

Application filed August 22, 1893. Renewed August 8, 1894. Serial No. 519,774. (No model.)

To all whom it may concern:

Be it known that I, WELLINGTON P. KIDDER, a citizen of the United States of America, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Safety Devices for Elevators, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention is designed more particularly as an improvement on the safety devices shown in my Patent No. 495,094 and my application, Serial No. 473,780, filed May 11, 1893, but it may be applied in part to other elevators.

In most all power elevators, it is found to be important to provide stops on the rope near the top and bottom thereof, which are engaged by the elevator in case the operator fails to stop the car at its extreme upward or downward motion; which is very necessary, as otherwise the motion of the car would continue and the car rise so high or descend so low as to do great damage. The use of these stops causes the car, when it reaches a certain point in its motion in either direction, to move the rope and thus stop the car, but it often happens with some elevators that the momentum of the car moves the rope too far—so far in fact as to open the valve and start the car in the opposite direction, so that the car might thus travel up and down continuously until the power was stopped or the rope properly adjusted by hand. Besides this difficulty there is another one which will occur where my safety stops are used. If the car moves the rope too far to stop, it would carry my safety stop entirely past the opening between the horizontal bars on the door, and if any one just at the moment when the stop was thus passing, tried to open the door, my stop might be caught by the bars on the door and thus damage would result. To overcome these difficulties is the object of my improvement, and to this end the invention consists in the construction, arrangement and combination of parts hereinafter more particularly described and then definitely claimed at the end hereof.

In the accompanying drawings—Figure 1 is a side view of an elevator arranged according to my invention with parts represented broken away or removed the better to show other parts thereof. Fig. 2 is a modification on a larger scale.

Referring now to the details of the drawings by letter, A represents the well of an elevator, B one of the doors thereof, C the car and D the operating or controlling rope thereof (which I shall hereinafter generally call the controller), all of which may be of any approved construction, excepting the door which, preferably, should be provided with vertical and horizontal bars or stops marked *b* and *b'* respectively.

Rigidly mounted on the controller D are blocks E, one being near the top and the other near the bottom of the well. Beneath the upper block is shown a spiral spring F, wound open, and above the lower one is a similar spring. The upper spring should be mounted so as not to fall down, which may be done by attaching it to the block E in any convenient way. These springs may be attached to the top and bottom of the car and travel with it if preferred, but I consider it best to connect them to the blocks E E. These springs must be so stiff as not to be compressed in the ordinary action of the elevator, so that the car when it comes in contact with one of the springs, will move the block E and controller the same as if the spring were not there.

Ordinarily the springs will not yield, but if the momentum of the car should be so great as to be sufficient to carry the car too far, then, in case the controller is arrested from any cause so that the block E could not go any higher, then if the momentum of the car continues, the spring will be compressed and no injury would result therefrom. In some cases, I may attach a spring (shown in dotted lines at I) to the under side of the beam, in which case the block E would come in contact with the spring if carried too far up by the momentum of the car and thus said spring I would act as a buffer This spring I may be used either with or without the spring F.

To overcome the other difficulty referred to, I propose to make a yielding connection between the controller and my rope-stops. One of the best ways of carrying out this feature of my invention is that shown in the drawings, but I do not wish to limit myself to this, as it may be done in various ways.

Referring again to the drawings: J repre-

sents a supplementary rope carrying the safety stop K, which is preferably fast thereon and co-operates with the bars *b* and *b'*, as in my application No. 473,780. This rope passes around suitable pulleys L and its opposite ends are preferably attached to closely wound springs M whose other ends are attached to the stops E, or to any convenient portions of the controller. Should the car now carry the block above its proper height, and an attempt be made to open the well door at the time that the safety rope-stop K is passing the opening between the bar-stops, so that the stop would be partly entered into the opening, the spring connection M, between the safety rope-stop K and the block E, would yield and thus no damage result. As a further precaution, I cut off the corners at the junction of the horizontal and vertical bars diagonally or slantingly as shown, so that should the door not be closed far enough to be latched, the stop pushing against such diagonal corner would push the door fully "home," and thus the latch would catch fast.

Instead of the spring connection between the rope J and the stop K, I may sometimes loosely mount the safety-stop on the rope J between springs N, as shown in Fig. 2. In this case if there should be any improper motion given to the rope J at a time when the stop K was between the horizontal door stops, the springs would yield and thus damage would be prevented.

Of course the springs M or N should be sufficiently strong as not to be operated by hand, or otherwise they might be used in such a manner as to entirely defeat the object of my safety stop.

In some cases instead of using springs, I may attach the stop K by a frictional connection, so that should there be any extra strain it would slide on the rope J, but this would not be so good as the other arrangements described, inasmuch as after sliding on the rope the stop would require to be adjusted to its proper position.

In addition to the advantages above set forth, the supplementary rope J above described has the further advantage that it forms a very convenient way of attaching my safety device to elevators already in use, for it frequently happens that the ordinary controller or rope is not in a position to conveniently receive the safety stops, and cannot well be changed in such a manner as to hold the stops in the proper position to act on the door.

I have used the beam supporting the pulleys and controller in the arrangement first described above, as a stop to prevent the block E from rising too high, but of course any other fixed part of the frame may be used as a stop for said block. Instead of the block, a pin passing through the rope at right angles and properly secured may be used. Other forms of stops may perhaps be used with as good advantage, but I prefer a block, and when I mention a "block" in the following claims, I mean to include any known device that will serve the same function, the word "block" being used here to more clearly distinguish it from stops co-acting with the doors. These spring connections may also be used with any other form of controller as well as with the rope controller shown.

In some cases, the springs or bumpers F may sufficiently protect my safety stop and door mechanism from injury, in which case the springs M or their equivalents may not be required.

In the drawings I have shown my safety rope-stop K acting upon the door through the medium of horizontal and vertical bars *b'* and *b*, but do not limit myself to this arrangement.

In the following claims, when I refer to "co-acting" or "engaging" with the door, I wish to be understood as meaning any arrangement of the parts in which the doors and stop co-act together, whether the door and stop are in immediate conjunction or co-act through intermediate mechanism.

What I claim as new is—

1. In an elevator and in combination with the controller and car thereof, of a block on the controller acted on by the car, and a spring co-acting therewith, substantially as described.

2. In an elevator and in combination with the controller and car thereof, a door, and a stop to engage with the door yieldingly connected with the controller, substantially as described.

3. In an elevator and in combination with the controlling rope, a door and the car thereof, a supplementary stop-carrier connected with the controlling rope and having stops co-acting with the door, substantially as described.

4. In an elevator and in combination with the controller, a door, and the car thereof, a supplementary stop-carrier connected with the controller, and a spring connection between the controller and the stop carrier, substantially as described.

5. In an elevator and in combination with the controlling rope, a door, and the car thereof, a supplementary stop-carrier, a block on the controlling rope, and a spring connection between the block and supplementary rope-carrier, substantially as described.

6. In an elevator and in combination with the controller and the car thereof, a stop connected with the controller, and a door having a stop engaging with the controller stop and having its corners cut slantingly, substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses, this 21st day of August, 1893.

WELLINGTON P. KIDDER.

Witnesses:
P. B. RISMAN,
M. P. EVANS.

(No Model.) 2 Sheets—Sheet 1.

W. P. KIDDER.

SAFETY DEVICE FOR ELEVATORS.

No. 525,422. Patented Sept. 4, 1894.

Fig 1.

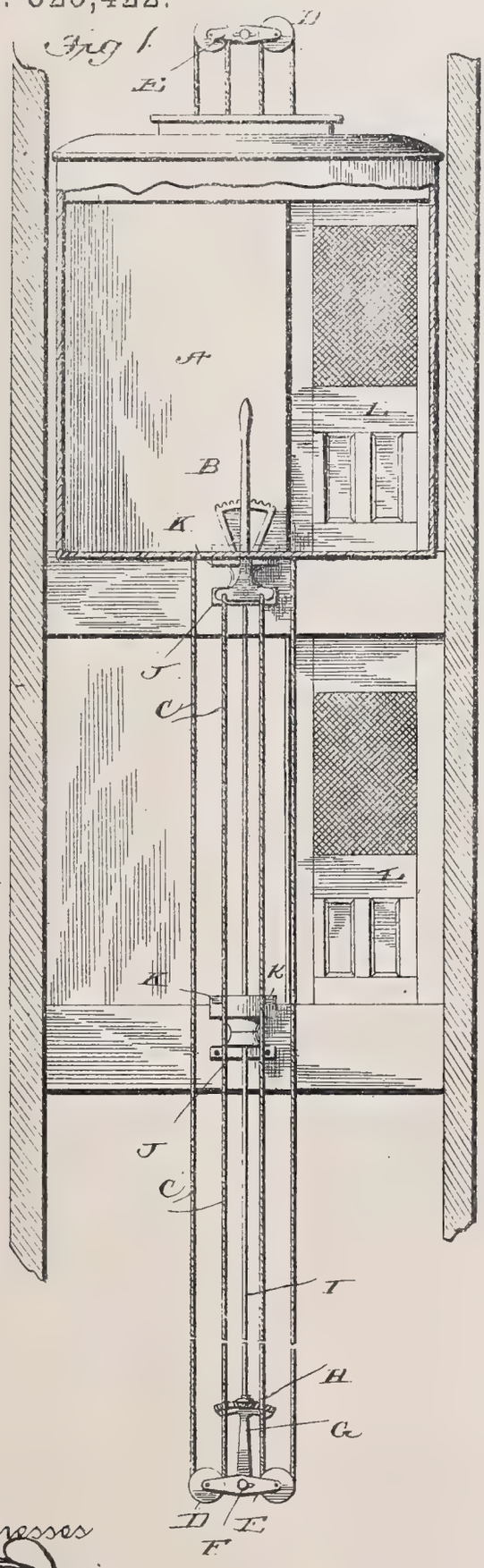


Fig 2

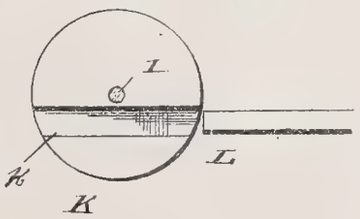


Fig 3

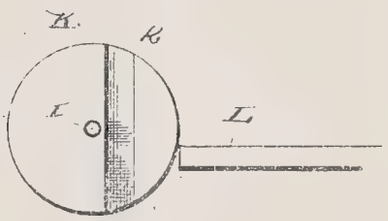
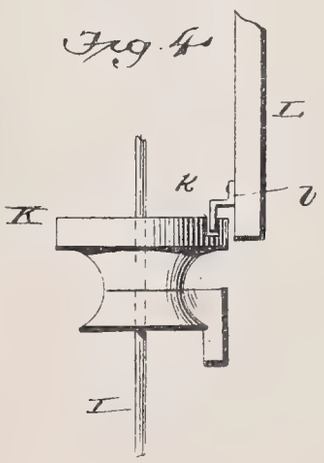


Fig 4



Witnesses
John E. Devine
Thos. E. Robertson.

Inventor
Wellington P. Kidder
By T. J. W. Robertson
Attorney

(No Model.) 2 Sheets—Sheet 2.

W. P. KIDDER.

SAFETY DEVICE FOR ELEVATORS.

No. 525,422. Patented Sept. 4, 1894.

Fig 5

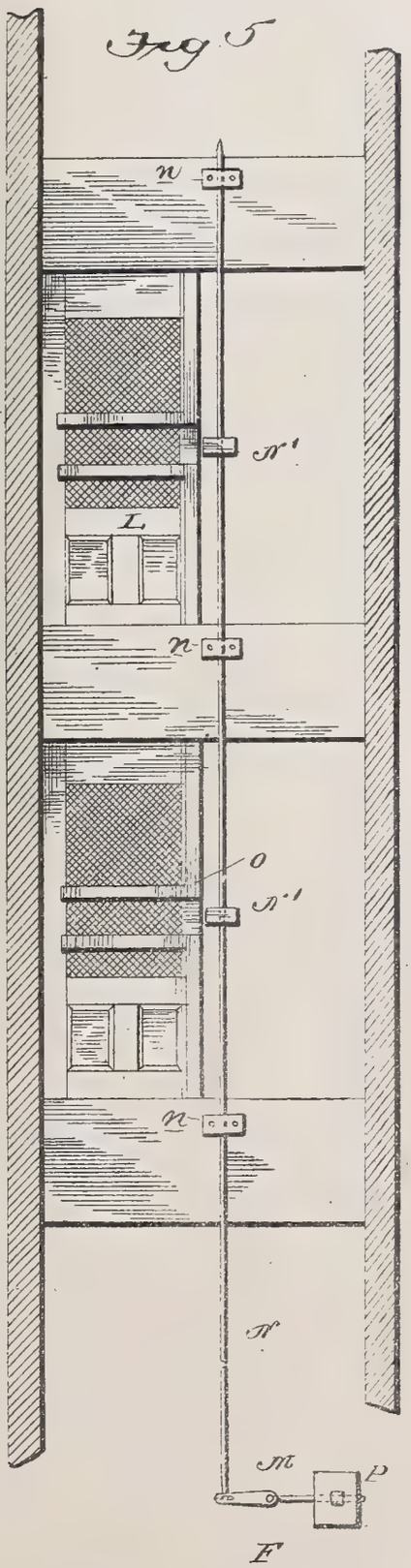


Fig 6

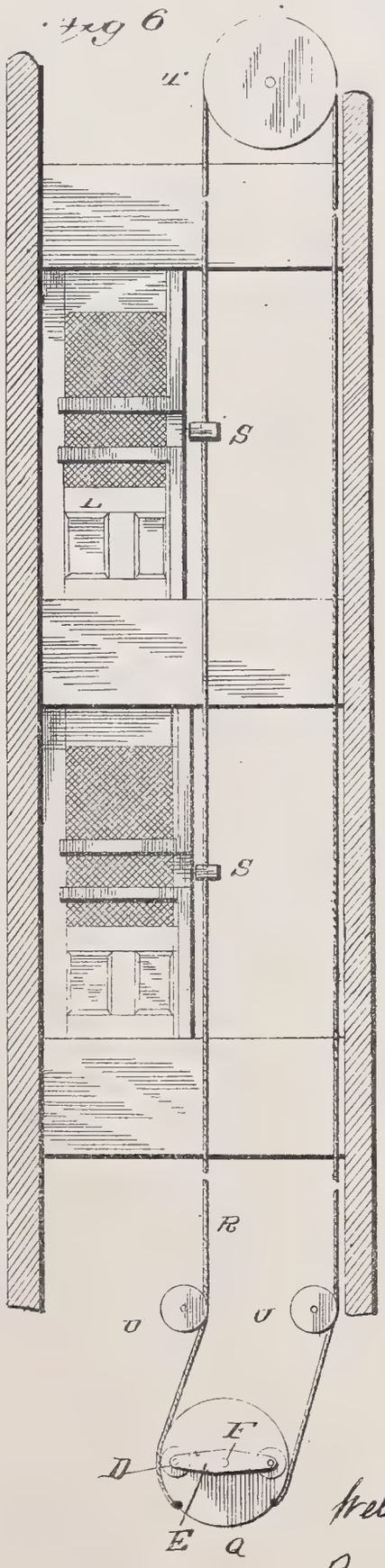


Fig 7.

Witnesses
John Innis
Thos. E. Robertson.

Inventor
Wellington P. Kidder
By T. J. W. Robertson
Attorney

UNITED STATES PATENT OFFICE.

WELLINGTON P. KIDDER, OF BOSTON, MASSACHUSETTS.

SAFETY DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 525,422, dated September 4, 1894.

Application filed May 22, 1893. Serial No. 475,081. (No model.)

To all whom it may concern:

Be it known that I, WELLINGTON P. KIDDER, a citizen of the United States of America, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Safety Devices for Elevators, of which the following is a specification, reference being had therein to the accompanying drawings.

This improvement relates to safety devices on the principle of that shown in my Patent No. 495,094, dated April 11, 1893, but of different construction, part of which may be used in connection with the stops shown in my aforesaid patent and also with the stops shown in my application for a patent, Serial No. 473,780, filed May 11, 1893, and is designed to use such safety devices in connection with the starting levers or "controllers" sometimes used in lieu of the usual operating rope. To enable me to use my aforesaid safety devices with such starting levers, I have devised a plan of connecting the stops with said starting levers, which is shown in the accompanying drawings, fully described herein, and then definitely claimed at the end hereof.

In the accompanying drawings—Figure 1 is an elevation showing the car, well doors, &c., looking toward the well doors. Fig. 2 is a plan of the same with the stop in position to allow the door to open. Fig. 3 is a plan showing the door locked by the stop. Fig. 4 is a modification showing a different connection between the door and stop. Fig. 5 is a modification with stops such as shown in my application before referred to, but with a rigid stop carrier, instead of the rope as shown in said application. Fig. 6 is an elevation of another modification in which supplemental ropes are employed to carry the stops. Fig. 7 is another modification of the rope stop carrier.

Referring now to the details of the drawings by letter and particularly to Figs. 1 to 3, A represents the car which may be operated in any suitable way, and is provided with the starting lever or controller B, to which is connected the valve operating ropes C, which pass over and under pulleys D mounted on levers E, the lower one of which should be connected with the valve or other device for setting the hoisting apparatus in motion and is fixedly attached to a shaft F, but as this device is well known and forms no part of my invention, it is unnecessary to further describe the same.

On the shaft F, I secure a toothed segment G, which gears with a pinion H, on a shaft I, mounted in suitable bearings J, and carrying a series of disks K, one for each well-door, each disk having a groove *k* of sufficient width to allow the bottom of a well door L to slide through it.

The operation is as follows: Supposing the car to be in motion, the stop will be in the position shown in Fig. 3, and the well door cannot be opened as its edge would come in contact with the disk K, but as the operator moves the lever B to the position shown in Fig. 1 to stop the car, the segment operates on the pinion H, thus turning the shaft I and causing the stop to assume the position shown in Fig. 2, in which position the well door can be opened. After the door is opened, the lever B is locked fast and thus the shaft I cannot be turned, and so the car cannot be started, as no motion can be given to the lever or levers E, because the shaft I is kept from turning by the door L being in the groove *k;* but when the door is closed, it will have been moved out of the groove *k* and then the shaft I and the gearing connected thereto can be readily moved and the car started.

It is obvious that instead of the bottom of the door being made to pass through the groove, in the disk K, shown in Figs. 1 to 3, a projecting plate *l* such as is shown in Fig. 4 extending along the bottom of the door L may be arranged to pass through a groove in the disk K in the same manner as the door passes through the groove. Such a projecting plate, I should consider as part of the door and where I use the word "door" in the claims at the end of this specification, I mean a door either with or without such a projecting plate as the case may be.

In the modification shown in Fig. 5, I attach to the shaft F a lever M to one end of which is pivoted a rod N running in suitable guides *n* and carrying the rising and falling stops N′ which co-act with the door stops O, as shown in my application above referred to or with the doors as shown in my aforesaid Patent No. 495,094. The lever M is preferably

provided with a counterbalance weight P. The rod N may be sufficiently rigid to dispense with the guides for the stops shown in my application, Serial No. 473,780. Instead of using the shaft I or rod N, I may use a rope to carry the stops, as shown in my above mentioned patent and application, in which case I attach to the shaft F a pulley Q (see Fig. 6) to which I connect the ends of the stop rope R having stops S fast thereon, which rope passes around a pulley T at the top of the elevator well. At U are shown guide pulleys to deflect the stop rope in the desired position, to suit the doors, but these will not be required in all cases. Instead of using the pulleys Q T, I may provide the levers E with extensions as shown in Fig. 7, to which I attach ropes R, one of which carries the stop S. Any movement imparted to the starting lever will of course give motion to the levers E, and these in their turn will give motion to the ropes R, and thus the stop S will be moved up and down, or left at the central position as desired. Of course where ropes are used to carry the stops, there should be guides employed to keep them in position, although I have not shown them in the drawings. Wires, rods, straps, chains or other similar equivalents may be used in lieu of the rope R if desired, without departing from the spirit of my invention, and the better to define my invention I shall generally use the term "stop carrier" in lieu of "rope" in my claims.

When referring to the device or devices carrying the stops I do not limit myself to the particular form of operating lever and connections shown, but intend to attach my supplementary stop connection with any and every form of controlling device I may find convenient to use it with, and should consider any such controlling device or controller as an equivalent of the lever and ropes shown in the drawings, except in claims where a lever and rope are specifically referred to.

I am aware that it has been proposed to provide a door with a plate or stop adapted to enter a groove in the bottom of a car, so that said car cannot readily be moved until the door has been closed; but such an arrangement is essentially different from mine, inasmuch as there is nothing in such device to prevent the moving of the rope to start the hoisting machinery, which may therefore be started, with the probability of breaking off the plate or stop from its fastenings or damaging the door or elevator cage, and with the further liability of damage to life or limb after such first-mentioned damage had been accomplished, while with my invention the hoisting machinery cannot be started until the door is closed. I am also aware that a swinging door has been provided with swinging projections adapted to pass through recesses in movable stops, but this is also objectionable, because the door can be used as a lever of considerable power when being swung open, and thus the stops may be broken or displaced by the great power that can be exerted by the projections on the door coming into contact with the stops, as such projections form the short arm of a lever, while the door forms a long arm thereof, and thus great damage may result from an attempt to open the door when the stops are in position to keep it closed. With my arrangement, on the contrary, the door slides and thus cannot be used as a lever, and any attempt to open the door when the stops are arranged so as to keep it closed would only act to "cant" the door over to the top as it strikes against the stop at the bottom, and thus serve to jam the door fast, so that it could not be opened, and the greater the force exerted under these circumstances, the faster the door would be held closed.

What I claim as new is—

1. The combination in an elevator and with the car and well doors thereof, of a controller for the motive power, a supplemental stop carrier operated by but distinct from said controller, and supplementary stops for fastening the doors closed, mounted on, carried by and moving with said supplemental stop carrier.

2. The combination in an elevator and with the car and the well doors thereof, of a lever mounted on the car, ropes connecting it with the hoisting mechanism, and a stop carrier distinct from the rope and having secured to and moving with it stops for each well door, constructed and arranged to simultaneously lock all of said doors connected to and moving simultaneously with the lever, substantially as described.

3. In an elevator and in combination with the well doors thereof, a turning shaft running from floor to floor, and stops for each door mounted on and operated by said shaft and securely fastening said doors closed, substantially as described.

4. In an elevator and in combination with the well doors thereof, a turning shaft, and stops for each door mounted on, carried and operated thereby and securely fastening said doors closed, substantially as described.

5. In an elevator and in combination with the well doors and the car thereof, a turning shaft running to the different floors and grooved disks mounted thereon, constructed to receive the doors in the grooves when the car is at rest, substantially as described.

6. In an elevator and in combination with the well doors, the car and controller thereof, a stop carrier distinct from the controlling rope running to the different floors, stops for fastening each door securely closed, mounted on and carried by said carrier and intermediate mechanism, substantially as described, between the controller and the stop carrier, as set forth.

7. In an elevator and in combination with a well door, the car and controller thereof, a shaft connected with the controller, a toothed segment on said shaft, a pinion gearing with

such segment, a shaft on which said pinion is mounted, and a stop connected to said shaft, substantially as described.

8. In an elevator and in combination with a well door, the car and the starting lever thereof, the ropes C, levers E, shaft F, segment G fast on shaft F, pinion H meshing with said segment, the shaft I carrying said pinion, and the grooved disk K mounted on said shaft and co-operating with the well door, substantially as described and shown.

In testimony whereof I affix my signature, in presence of two witnesses, this 19th day of May, 1893.

WELLINGTON P. KIDDER.

Witnesses:

EDWARD S. BEACH,

F. L. GOODHUE.

(No Model.) 2 Sheets—Sheet 1.

L. S. BUFFINGTON & W. C. JONES.

ELECTRIC ELEVATOR CONTROLLER.

No. 530,578. Patented Dec. 11, 1894.

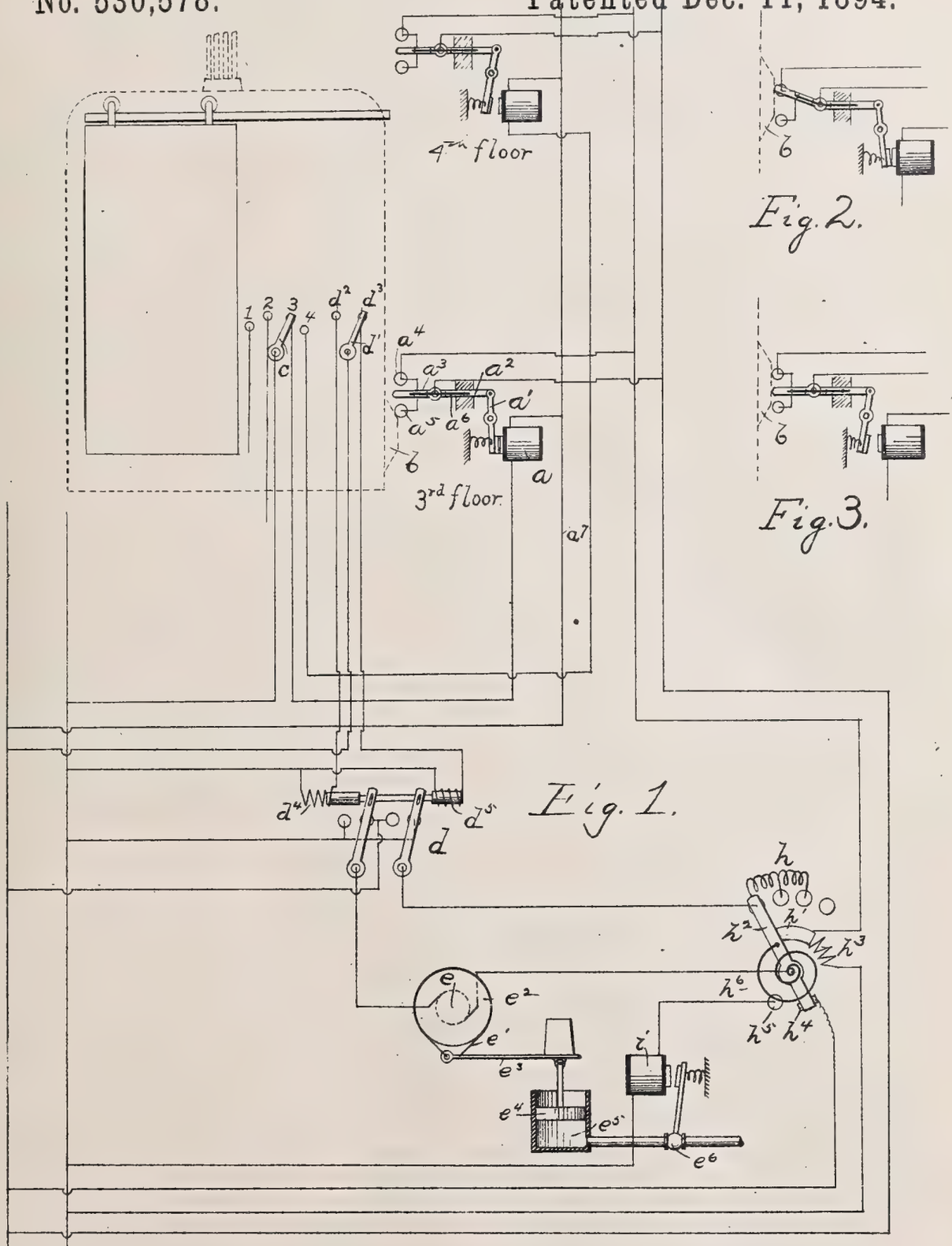


Fig. 1.

Fig. 2.

Fig. 3.

Witnesses:
George L. Cragg
George S. Buell

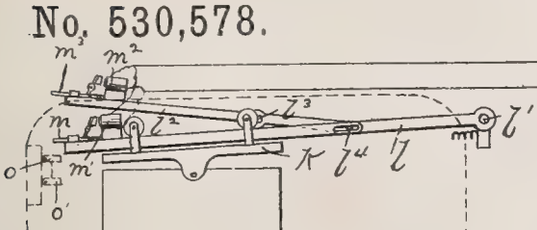
Inventors:
Leroy S. Buffington,
Walter Clyde Jones
By Burton Brown
Attys.

(No Model.) 2 Sheets—Sheet 2.

L. S. BUFFINGTON & W. C. JONES.

ELECTRIC ELEVATOR CONTROLLER.

No. 530,578. Patented Dec. 11, 1894.



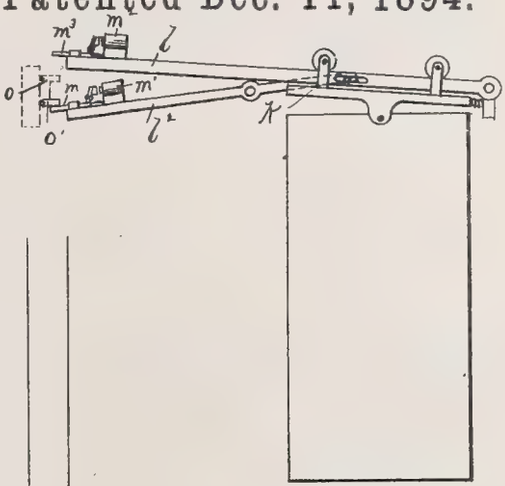


Fig. 5.

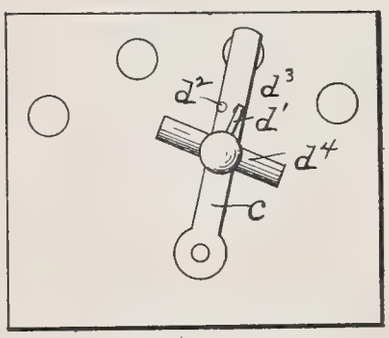


Fig. 6.

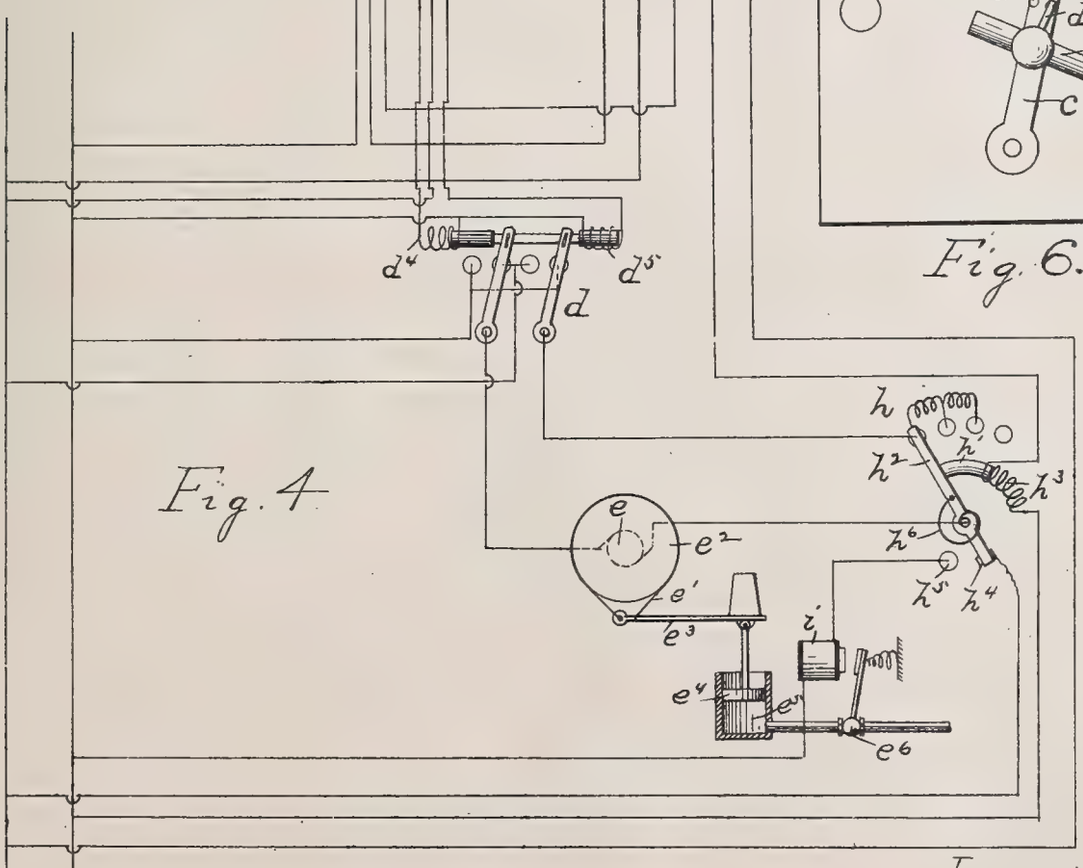


Fig. 4.

Witnesses:

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Leroy S. Buffington

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Attys.

UNITED STATES PATENT OFFICE.

LEROY S. BUFFINGTON, OF MINNEAPOLIS, MINNESOTA, AND WALTER CLYDE JONES, OF CHICAGO, ILLINOIS.

ELECTRIC ELEVATOR-CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 530,578, dated December 11, 1894

Application filed February 23, 1894. Serial No. 501,116. (No model.)

To all whom it may concern:

Be it known that we, LEROY S. BUFFINGTON, residing at Minneapolis, county of Hennepin, and State of Minnesota, and WALTER CLYDE JONES, residing at Chicago, county of Cook, and State of Illinois, citizens of the United States, have invented a certain new and useful Improvement in Electric Elevator-Controllers, (Case No. 1) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to electric elevator controllers, and more particularly to means for automatically controlling the elevator car and the elevator doors.

The object of our invention is, first, to provide means for automatically bringing the elevator car to rest opposite any floor; second, to provide means for automatically opening and closing the elevator doors without positively connecting the same with the moving elevator car at any time; and, third, to provide an elevator system which will be more automatic in its operation than systems heretofore in use.

Our invention consists, first, in an elevator system comprising an electro-magnetic device for controlling the motive power, switches at the several floors, which may be designated floor switches, which are adapted to be actuated to control the circuit through the controlling electro-magnetic device, electro-magnetic devices adapted to control the position of the floor switches, whereby the same may or may not be engaged by the moving elevator car, and switching apparatus carried upon the elevator car and adapted to control the electro-magnetic devices that control the floor switches.

Our invention consists, second, in an elevator door suspended from and adapted to slide upon a pivoted bar serving as a track, the bar normally resting with its free end at a less elevation than the pivoted end, an inclination being thereby imparted to the bar to maintain the door closed, means being provided for raising the free end of the pivoted bar by engagement with the moving elevator car, the bar being thereby inclined in a reverse direction, whereby the door is caused to slide open, means being also provided whereby the operator may release the pivoted bar permitting the same to return to its normal position to cause the door to close.

Our invention consists, third, in an elevator system comprising an electro-magnetic device for controlling the motive power, switches at the several floors, adapted to be actuated by the movement of the several doors to control the circuit through the power controlling electro-magnetic device, elevator doors adapted to operate in their movement the several floor switches, and switching apparatus carried upon the elevator car and under the control of the operator for placing the elevator doors in condition to be actuated by the moving elevator car.

Our invention consists, fourth, in such other constructions as will be hereinafter described.

We believe that it has not heretofore been proposed to automatically bring the elevator car to rest at any predetermined floor through the agency of apparatus controlled by the operator in the car.

In the system of our invention, as herein after illustrated, the operator is provided with switching apparatus placed in the car, which may comprise a lever moving over a series of contact points, by means of which he may close circuit through any one of a number of electro-magnets placed upon the wall of the elevator shaft at the respective floors. The closing of the circuit through one of the electro-magnets serves to place the circuit closing element of a floor switch in the path of a projection upon the elevator car. The movement of the elevator car serves to actuate the floor switch an instant before the car reaches the level of the floor where it is desired to stop, and the actuation of the floor switch closes circuit through an electro-magnetic device, which, when excited, cuts off the motive power and brings the car to rest. In an electric elevator system the motive power is derived from the motor, and the excitation of the electro-magnetic device may serve first to open the armature circuit, and then to throw on a brake. In starting the car again it is only necessary to open the circuit through the magnet controlling the floor switch, by

means of the switching apparatus on the car when the floor switch will, through the resiliency of a spring, or otherwise, open the circuit through the electro-magnetic device controlling the motive power. The armature switch may be adapted to be closed through the resiliency of a spring, or otherwise, and the brake may be thrown off through the agency of compressed air in a well known manner.

To secure automatic operation of the elevator doors each is suspended from and adapted to slide upon a bar, serving as a track, said bar being pivoted at one end and normally resting with its free end at a less elevation than its pivoted end, an inclination being thereby imparted to the bar which serves to maintain the door in a closed position. Upon the end of said bar, as well as upon a bar adapted to be engaged by the car in its downward travel, is provided a tongue adapted to be moved into or out of the path of a projection on the elevator car, through the agency of an electro-magnet carried upon the end of said bar. The circuit of the electro-magnet extends to the elevator car, whereby the operator may close or open circuit through the same to cause the tongue to move into or out of the path of the projection, as desired. When the tongue is moved into the path of the projection on the car, the movement of the car raises the free end of the pivoted bar, thus imparting to it an inclination in a reverse direction, thereby causing the door to open by sliding down the inclined track thus produced. The door being thus opened, the tongue may be withdrawn from engagement with the projection on the car, thus permitting the free end of the pivoted bar to descend, imparting to the same an inclination in a direction to cause the door to close.

We are enabled to produce an entirely automatic elevator system by so placing the floor switches that they will be operated by the opening of the elevator door, circuit being preferably maintained open through the electro-magnetic device that controls the motive power, so long as the door remains closed, and closed so long as the door remains opened. By this construction the operator is able at will to place any door in position to be opened by the car, and the door at the instant of starting operates the means provided for bringing the car to rest. When it is desired to start the car the operator can withdraw the tongue, thereby permitting the door to close. The door at the instant of closing operates the means provided for starting the car. The only attention requisite on the part of the operator is to properly manipulate the switching apparatus upon the car.

Our invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic representation of an elevator system equipped after our invention, the elevator car being shown in dotted lines. Fig. 2 is a view showing the floor switch in a position to close circuit through the electro-magnetic device controlling the motive power. Fig. 3 is a similar view showing the position assumed by the switch when the electro-magnet is de-energized, the circuit being thereby opened. Fig. 4 is a diagrammatic view of a system equipped after our invention, the door being adapted to be automatically opened and closed, and the car being adapted to be brought to rest opposite any desired floor automatically; the elevator car being shown in dotted lines. Fig. 5 is a view showing the door in its opened position, the projection on the elevator car being shown in dotted lines. Fig. 6 is a view of the operator's switching apparatus.

Like letters and numerals refer to like parts throughout the several figures.

In Fig. 1 we have illustrated that part of our invention which relates to the automatic stopping of the elevator car opposite the desired floor. At each floor is provided an electro-magnetic device and a switch. The electro-magnetic device may be in the form of an electro-magnet a acting upon an armature carried upon the end of a pivoted lever a'. The other end of the lever a' is connected with the longitudinally movable rod a^2 supported in a bearing and carrying upon its end the switch lever a^3 pivoted thereto and adapted to make contact with contact points a^4 or a^5. To the rod a^2 and the switch lever a^3 is attached a spring a^6 which tends to maintain said rod and lever in a straight line and to return the lever to this position when displaced to either side.

Upon the elevator car is provided a projection b which is adapted to impinge against the lever a^3 when in its outer position to cause the same to make contact with one or the other of the contact points. When the electro-magnet is excited the lever is brought in position to be engaged by the projection on the car, and when not excited the lever is not in position to be so engaged.

Upon the elevator car is provided a contact arm c provided with a handle whereby the same may be easily manipulated by the operator, said arm being adapted to be moved over a series of contact points 1, 2, 3, 4. The contact arm is electrically connected with one side of an electric circuit, while each of the contact points is connected with one terminal of one of the electro-magnets placed at the several floors. Thus contact point 3 is connected with electro-magnet a at the third floor, and contact point 4 is connected with the electro-magnet at the fourth floor. We have not illustrated the switching apparatus at the first and second floors but such apparatus may be the same as that illustrated at the third and fourth floors. The other terminal of each of the electro-magnets is connected with a common wire a^7 extending to the other side of the source of electricity. When the contact arm c rests upon a contact

point, as, for instance, contact point 3, one of the electro-magnets will be excited and the switch will be placed in position to be engaged by the elevator car. Thus, as illustrated, the contact arm *c* is on contact point 3 and the switch at the third floor is in position to be engaged by the car. In the car is provided also means for operating a reversing switch *d*. This may consist of an arm *d'* connected with one side of an electric circuit and adapted to make contact with terminal points d^2 d^3 connected respectively through solenoids d^4 d^5 to the other side of the circuit. When the arm rests on one contact point one of the solenoids is excited and acts upon its core to place the switch in one position, and when it rests upon the other the position of the switch is reversed.

The reversing switch is included in circuit with the armature of the motor *e*, as is also a rheostat *h* comprising terminal points between which are included resistance coils, and an arm h^2 adapted to be moved over the terminal points. To the arm is secured the core *h'* of a solenoid h^3 in such manner that when the solenoid is excited the arm will be caused to traverse the terminal points. The solenoid h^3 is included in circuit with the floor switches, the latter being placed in multiple with one another.

We have shown the motor as provided with a friction band brake, comprising a band *e'* encircling a pulley e^2 on the armature shaft. The band is connected with a weighted lever e^3 in a well known manner, the end of the lever being maintained in an elevated position by compressed air acting on a piston e^4 provided in the cylinder e^5. A valve e^6 is provided in the pipe leading to the compressed air supply adapted to maintain the cylinder e^5 in communication with the compressed air supply until the magnet *i* is energized, when the valve is operated to open the cylinder to the external air and to cut off the compressed air supply. The compressed air being removed from beneath the piston e^4 the latter descends, due to the weight on the end of the lever, thus causing the friction band to grip the pulley and bring the motor armature to rest.

The operation of the system, as thus described, is as follows: Suppose the car in the act of ascending and the operator desirous of stopping at the third floor. The contact arm *c* is moved to make contact with terminal point 3, thereby closing circuit through electro-magnet *a*, which, being excited, attracts its armature to thrust the lever a^3 into the path of the projection *b* on the elevator car. The projection *b* on the car in its ascent impinges against lever a^3, causing the same to make contact with contact point a^4 thereby closing circuit through solenoid h^3. Solenoid h^3 being excited attracts its core *h'*, thereby causing contact arm h^2 to move over the terminal points to gradually cut resistance out of and finally open the armature circuit. At the instant the armature circuit is opened the brush h^4, carried on the extended end of arm h^2, makes contact with terminal h^5, thereby closing circuit through magnet *i* which attracts its armature to cut off the supply of compressed air and open the cylinder e^5 to the external air, thereby permitting the setting of the brake which brings the motor armature, and, consequently, the elevator car, to rest. When it is desired to start again the contact arm *c* is moved to some other position, magnet *a* being thereby de-energized to permit the spring attached to lever *a'* to draw back the lever a^3 out of the path of the projection *b*, the spring a^6 then acting upon lever a^2 to cause it to break contact with terminal a^4. Circuit being thus opened through solenoid h^3, the spring h^6 causes arm h^2 to move to break circuit through magnet *i*, thereby releasing the brake, and to close circuit through the motor armature and then to cut resistance from the armature circuit, thus starting the elevator car. The car is automatically stopped at the floor corresponding to the terminal with which the arm *c* makes contact, and during the travel the arm *c* may be moved slightly in advance of the car so that the car may be stopped at any floor that may be called without reversing the motion of the arm *c*. When it is desired to descend the arm *d'* is moved to operate the reversing switch and change the direction of the current through the armature.

In Fig. 4 we have illustrated the above described system of automatically stopping the elevator car in connection with means for automatically opening and closing the elevator doors. The door is pivotally suspended from a bar *k* provided with rollers running upon the inclined bar *l* as a track. The bar *l* is pivoted at *l'*. A lever l^2 pivoted at l^3 is provided with a pin l^4 in its end adapted to work in a slot in said bar *l*, so that when the end of lever l^2 is depressed the free end of bar *l* is raised. Upon the end of bar *l* is provided a tongue *m* adapted to slide back and forth so that the end thereof may in one position extend beyond the end of the bar *l*. To the tongue is connected a pivoted lever carrying upon one end the armature of a magnet *m'*, which, when excited, attracts said armature to cause said tongue to extend beyond the end of the bar. A similar tongue is provided upon the end of lever l^2 and is similarly operated by a magnet m^2. The elevator is provided with switching apparatus similar to that described in connection with Fig. 1, and the motor connections and the brake are similar. Instead of floor switches adapted to be acted upon directly by the moving car, a switch *n* is provided adapted to be actuated by the door. Such a switch is provided at each floor and they are connected with the solenoid h^3 in the same manner as heretofore described. When the door is opened the switch is adapted to close the circuit through the solenoid h^3, and to main

tain the circuit open so long as the door is closed. The switch may be of any well known form, as for instance, a contact plate n' forming one terminal of the circuit and a plate n^2 forming the other terminal, the plate n^2 being held out of contact with plate n' while the door is closed, but being adapted to close against the same when the door is opened. Upon the elevator car are provided projections o o', one in the path of tongue m, and the other in the path of tongue m^3, projection o being so pivoted that it will permit the passage of lip m on the downward travel of the car, but will engage therewith on the upward travel. Likewise projection o' engages with tongue m^3 on the downward travel, but not on the upward travel.

The operation of the system, as above described, is as follows: The car being in its upward travel and it being desired to stop at, say, the third floor, the operator moves arm c to terminal 3. Circuit is thus closed through the magnets m', m^2, causing the tongues m and m^3 to be thrust forward. As the car continues the projection o impinges against tongue m, thereby raising the end of bar l, imparting to the same an inclination such that the door is caused to open by sliding down the inclined track thus produced. As the door opens the switch n closes the circuit through the solenoid h^3. The latter is excited to attract its core, causing the arm h^2 to move over the terminal points and open the armature circuit and throw on the brake, in a manner heretofore described. When it is desired to again start the car, the contact arm c is moved from terminal 3, thereby opening the circuit through magnet m' to de-energize the same and permit the tongue m to be withdrawn from engagement with the projection o, due to the reaction of a spring. The end of bar l being thus unsupported the same descends and imparts to the bar an inclination such that the opened door is caused to close by sliding down the inclined track. When the door completes its travel the switch n is opened, thus de-energizing the solenoid h^3 and starting the elevator car in a manner heretofore described. When it is desired to descend, the arm d' is moved to operate the reversing switch to change the direction of the current through the armature, and, consequently, the direction of travel of the elevator car.

The arm d' may be preferably mounted upon the arm c, as illustrated in Fig. 6, in which the arm d' is connected with the handle d^4 which is adapted to be given a slight rotary motion whereby said arm d' may make contact alternately with contact points d^2 d^3 carried upon the arm c. When the handle is at one or the other end of its stroke circuit will be closed through one of the solenoids of the reversing switch. The operator becoming accustomed to the positions of the handles in ascending and descending, will be enabled to control the car with the use of but one hand.

It is evident that many of the operations of the system as herein described may be accomplished by other means and in a different manner without departing from our invention. We desire, therefore, to claim broadly the features specified in the several clauses of claim.

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In an elevator system, the combination with an electro-magnetic device adapted to control the motive power, of a switch adapted to control the operation of said electro-magnetic device, an electro-magnetic device adapted to place an element in position to be engaged by the moving elevator car and thereby to cause the actuation of said switch, and switching apparatus provided upon the elevator car in electrical connection with said second mentioned electro-magnetic device and adapted to control the same, substantially as described.

2. In an elevator system, the combination with an electro-magnetic device adapted to control the motive power, of a switch adapted to control the operation of said electro-magnetic device, an electro-magnetic device, an element adapted to be placed thereby in position to be engaged by the moving elevator car and thereby to cause the opening of the elevator door, said door being adapted in its movement to actuate said switch, and switching apparatus provided upon the elevator car and adapted to control said second mentioned electro-magnetic device, substantially as described.

3. In an elevator system, the combination with an electro-magnetic device adapted to control the motive power, of a switch adapted to control the operation of said electro-magnetic device, a pivoted bar, an elevator door suspended therefrom, an electro-magnetic device, an element adapted to be placed thereby in position to be engaged by the moving elevator car, and thereby to raise the end of said pivoted bar to cause said door to open, said door being adapted in its movement to actuate said switch, and switching apparatus upon the elevator car and adapted to control said second mentioned electro-magnetic device; whereby the door is automatically opened and closed and the car is automatically brought to rest opposite a predetermined floor, substantially as described.

4. In an elevator system, the combination with a pivoted bar, of an elevator door suspended therefrom, and means for raising and lowering the free end of said pivoted bar to effect the opening and closing of the elevator door, substantially as described.

5. In an elevator system, the combination with a pivoted bar, of an elevator door suspended therefrom, an electro-magnetic device

adapted to place an element in position to be engaged by the moving elevator car, and thereby to raise the end of said pivoted bar to cause said door to open, and switching apparatus provided in the elevator car adapted to control said electro-magnetic device, substantially as described.

6. In an elevator system, the combination with switches provided at the several floors, of motor mechanism controlled by said switches, said switches being adapted to be actuated through the agency of the moving elevator car, and electro-magnetic devices controlled from the car for predetermining the switch to be actuated; whereby the car may be brought to rest opposite any floor, substantially as described.

7. In an elevator system, the combination with a contact arm adapted to be moved over a series of contact points, of circuit connections through said arm and contact points for controlling the movement of the elevator car, a lever pivoted upon said arm, a pair of contact points carried upon the said arm and adapted to be alternately engaged by said lever, and circuit connections through the lever and the pair of contact points adapted to control the direction of movement of the car, substantially as described.

8. The combination with a laterally sliding elevator door, of door opening mechanism for opening and closing the same through the agency of the weight of the door.

9. The combination with a laterally sliding elevator door, of means for opening the same through the agency of the weight of the door.

10. The combination with a laterally sliding elevator door, of means for raising the center of gravity of the same by the movement of the elevator car, and means for opening the door by the descent of the center of gravity of the door.

11. The combination with a laterally sliding elevator door, of means for raising the center of gravity of the same by the movement of the elevator car, mechanism for opening the door by the descent of the center of gravity, and means for closing the door by the descent of the center of gravity.

12. The combination with an elevator door, of means for opening the same through the agency of the moving elevator car, and a device for automatically stopping the car by the opening of the door, substantially as described.

13. The combination with an elevator door, of means for opening the same through the agency of the moving elevator car, and a device for automatically starting the car from rest by the closing of the door.

14. The combination with an elevator door, of means for opening the same through the agency of the moving elevator car, a device for automatically stopping the car by the opening of the door, and means for automatically starting the car from rest by the closing of the door, substantially as described.

15. The combination with an elevator door, of a moving elevator car, mechanism independent of the motion of the car for automatically opening said door, a device actuated by the moving elevator car adapted to place said mechanism in condition to open the door, and means for automatically stopping the car by the opening of the door.

16. The combination with an elevator door, of the elevator car, an electric switch thereon, an electro-magnetic device controlled thereby and means for opening the door through the agency of the moving car, said means being placed in operative condition by said electro-magnetic device.

17. The combination with an elevator door, of the elevator car, an electric switch thereon, an electro-magnetic device controlled thereby and means for opening the door through the agency of the moving car, said means being placed in operative condition by said electro-magnetic device, and means for automatically stopping the car by the opening of the door.

18. The combination with an elevator door, of the elevator car, an electric switch thereon, an electro-magnetic device controlled thereby, means for opening the door through the agency of the moving car, said means being placed in operative condition by said electro-magnetic device, and means for automatically starting the car from rest by the closing of the door.

19. The combination with an elevator door, of the elevator car, an electric switch thereon, an electro-magnetic device controlled thereby, means for opening the door through the agency of the moving car, said means being placed in operative condition by said electro-magnetic device, means for automatically stopping the car by the opening of the door, and means for automatically starting the car from rest by the closing of the door.

20. The combination with an elevator car, of an elevator door, mechanism independent of the motion of the elevator car for opening the door, said means being controlled in its time of operation by the movement of the car, a device actuated by the opening of the door for bringing the car to rest, and mechanism for starting the car from rest by the closing of the door, substantially as described.

21. The combination with an elevator car, of an elevator door, mechanism independent of the motion of the car for opening the same, an electro-magnetic device, a switch upon the car for operating the same, a movable element adapted to be moved into the path of the car by said electro-magnetic device, said car being adapted to engage the same to throw said door opening mechanism into operation, substantially as described.

22. The combination with an elevator car, of an elevator door, mechanism independent of the motion of the car for opening the same, an electro-magnetic device, a switch upon the car for operating the same, a movable element adapted to be moved into the path of the car

by said electro-magnetic device, said car being adapted to engage the same to throw said door opening mechanism into operation, and a switch controlled by said door for throwing on and off the motive power.

23. The combination with an elevator car, of an elevator door adapted to be opened through the agency of the moving car, an electric switch controlled by said door, an electro-magnetic device controlled by said switch, and motive mechanism adapted to move said car, controlled by said electro-magnetic device.

24. The combination with an elevator car of a series of contact terminals located thereon and connected respectively through electro-magnetic devices located at the several floors, a contact arm adapted to make contact with any one of said terminals to close circuit through the respective electro-magnetic devices, and mechanism controlled by said electro-magnetic devices for bringing the elevator car to rest opposite the respective floors.

In witness whereof we hereunto subscribe our names this 27th day of October, A. D. 1893.

LEROY S. BUFFINGTON.
WALTER CLYDE JONES.

Witnesses:
GEORGE L. CRAGG,
GEO. S. BUELL.

(No Model.)

J. COOPER.

ELEVATOR SAFETY DEVICE.

No. 536,605. Patented Apr. 2, 1895.

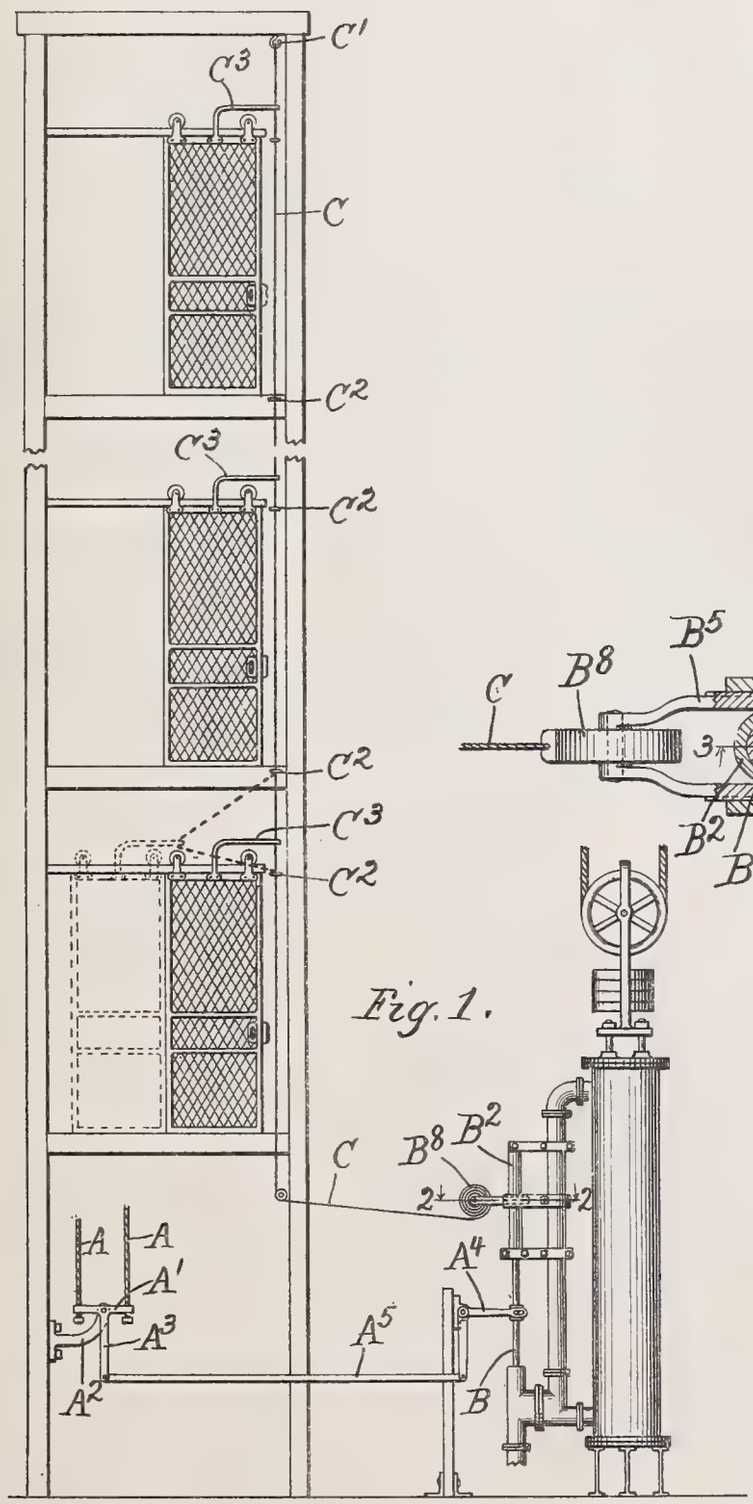

Fig. 1.

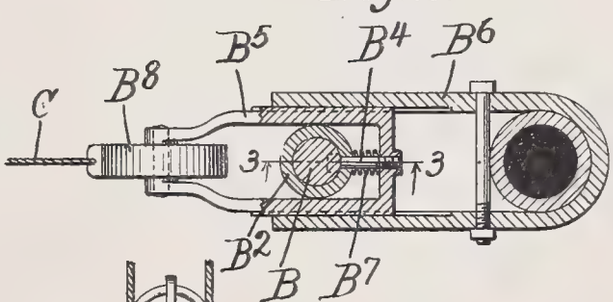

Fig. 2.

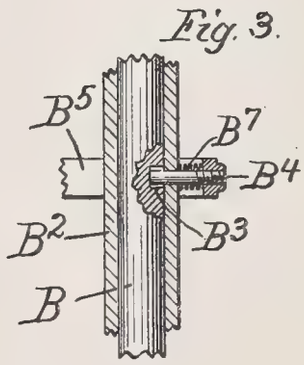

Fig. 3.

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UNITED STATES PATENT OFFICE.

JAMES COOPER, OF CHICAGO, ILLINOIS.

ELEVATOR SAFETY DEVICE.

SPECIFICATION forming part of Letters Patent No. 536,605, dated April 2, 1895.

Application filed April 5, 1894. Serial No. 506,410. (No model.)

To all whom it may concern:

Be it known that I, JAMES COOPER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Elevator Safety Devices, of which the following is a specification.

My invention relates to safety devices for elevators and has for its object to provide an improved device which, when used in connection with an elevator car, prevents said car from being started when the elevator door is open.

Referring to the accompanying drawings, Figure 1 is a view of the elevator shaft and driving mechanism of an ordinary hydraulic elevator with my device in position. Fig. 2 is a section on line 2—2 Fig. 1. Fig. 3 is a section on line 3—3 Fig. 2.

Like letters refer to like parts throughout the several figures.

In Fig. 1 I have shown a view of an elevator shaft with the elevator car omitted, the driving mechanism being of the ordinary hydraulic type. The controlling ropes or cables A A pass through the car and move in the ordinary manner by means of a lever on the car. The ends of these cables are attached to the cross piece A′, pivoted to the support A^2. Rigidly attached to the cross piece is the arm A^3 connected to the bell crank lever A^4 by the rod A^5. The other end of the lever A^4 is connected to the valve rod B, said connection being made in the ordinary manner by a sliding block. The valve rod B projects beyond the bell crank lever A^4 and extends into the tube B^2. A notch B^3 in said valve rod (see Fig. 3) is located so that it will come opposite the pin B^4 when the valve is closed. Said pin B^4 works in a hole in tube B^2 and is attached to one end of the box or frame B^5 surrounding the tube B^2 and working in the guides B^6. A spiral spring B^7 tends to keep the pin B^4 from entering the notch B^3. A coil spring B^8 has one end attached to the frame B^5, the other end being fastened to the flexible cord C which extends to the top of the elevator shaft, and is fastened to hook C′. C^2 C^2 are guides for cord C. Each elevator door is provided with an arm C^3, the cord C passing through a hole in the end of each arm. Any suitable device may be substituted for the coil spring B^8 which will allow the cord C to move a greater distance than the frame B^5, and at the same time exert a pull on said frame so as to keep the pin B^4 in the notch B^3 when said cord is moved by the opening of one of the doors.

My device may be used in connection with any sort of a valve, the only requirement being that the rod B is moved as the valve moves. In case the elevator is run by an electric motor, this rod B would be attached to the rheostat arm so that it would be locked when the elevator door is open.

It is evident that the several parts may be altered in form, construction and arrangement without departing from the spirit of my invention, and I therefore do not wish to be limited to the exact construction shown.

The use and operation of my invention are as follows: When the elevator doors are closed the cord C is suspended as shown in Fig. 1, and the spiral spring B^7 keeps the pin B^4 from engaging the valve rod B by entering the notch B^3 when the valve is closed, and hence the operator in the car can move the controlling lever or rope and hence the valve, and stop or start the car at will. If now the car is stopped at one of the floors and the door opened, the arm C^3 attached to said door carries the cord C with it (see Fig. 1) and thus shortens the cord. The frame B^5 and hence pin B^4 is pulled forward and, since the elevator is stopped, said pin enters the notch B^3 in the valve rod B. As this distance is very small some device must be used in connection with the frame that will allow the cord to be moved until the door is fully opened. Of course any suitable device may be used, the one shown in the drawings consisting of a coil spring B^8 having one end attached to the frame B^5. As the cord C shortens, said spring allows its motion to continue after the pin B^4 and frame B^5 cease to move. The spring as it is pulled out, is wound up so that it exerts a pull on the frame B^5 and keeps the pin B^4 in the notch B^3 while the door is open. When said pin is in said notch this valve rod is held rigid, and hence the valve cannot be moved so as to start the car. As the door is closed the cord C returns to its normal position, and when the said cord hangs straight the tension is taken from the frame B^5 and the spiral spring B^7 moves the pin out of the notch B^3 and frees

the valve rod B. The operator can now start the car.

As described above, the valve locking device may be said to consist of two parts, viz: the valve rod B and pin B^4, which move freely with relation to each other while the valve is open and which are adapted to be locked together when the valve is closed. It is evident that the result may be accomplished in a different manner than that shown in the drawings although I deem such illustration sufficient to show the nature of my invention.

It will thus be seen that I have here a device which prevents the elevator operator from starting the car until the door is closed, thus avoiding the danger of having persons injured by starting to pass through the door after the car is in motion.

It is evident that my device can be used in connection with any sort of a valve, and that it may also be used in connection with a rheostat arm or the like in case of electric elevators.

I claim—

1. The combination in an elevator apparatus of a motor mechanism, a moving element by which said motor mechanism is controlled, a rod attached to said moving element and provided with a single notch, a pin which is opposite said notch only when the motor mechanism is stationary, but normally out of engagement with said notch, and connections between said pin and the elevator doors, said connections being unbroken both when the doors are open and closed whereby the pin is forced into said notch when one of the doors is open, and the valve is closed.

2. The combination with the driving mechanism of an elevator, of a moving element by which said driving mechanism is controlled, a locking device for said moving element comprising two parts which move freely with relation to each other at all times when the driving mechanism is in motion but which are adapted to be locked together when the driving mechanism is at rest, and connections between said locking device and the elevator doors said connections being unbroken both when the doors are open and closed whereby the moving element is locked when one of the elevator doors is open and said moving element is in the position that brings the driving mechanism to rest.

JAMES COOPER.

Witnesses:
DONALD M. CARTER,
WALTER J. GUNTHORP.

(No Model.) 3 Sheets—Sheet 1.

W. P. KIDDER.

SAFETY DEVICE FOR ELEVATORS.

No. 543,153. Patented July 23, 1895.

Fig. 1.

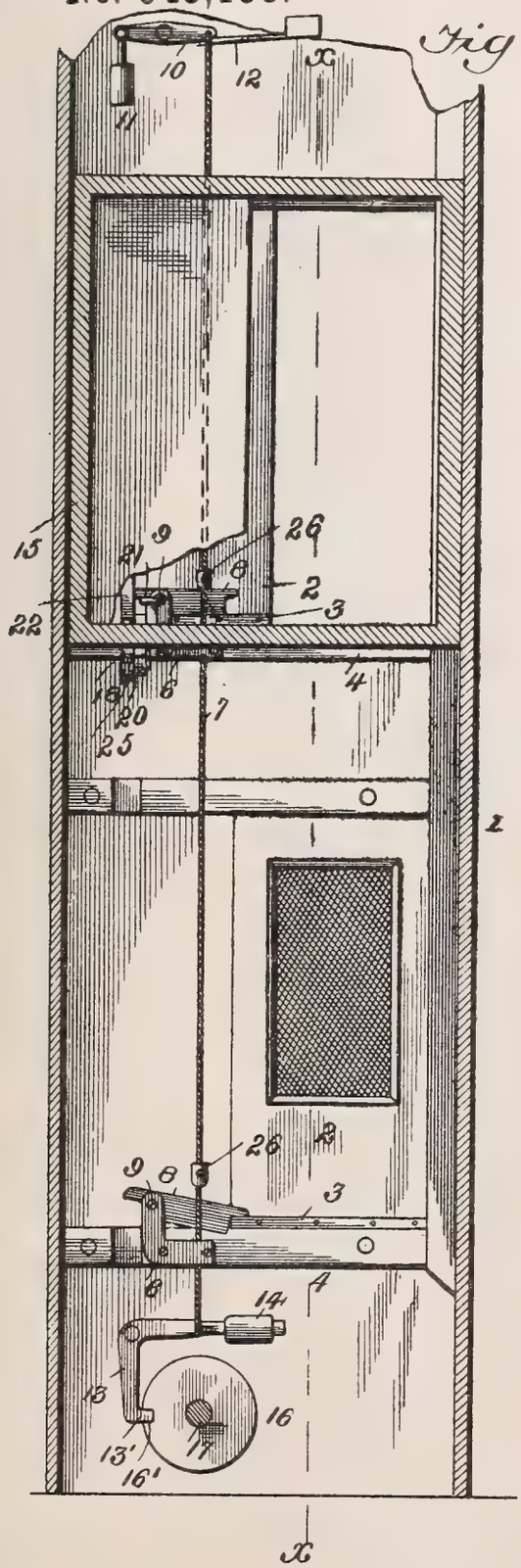


Fig. 4.

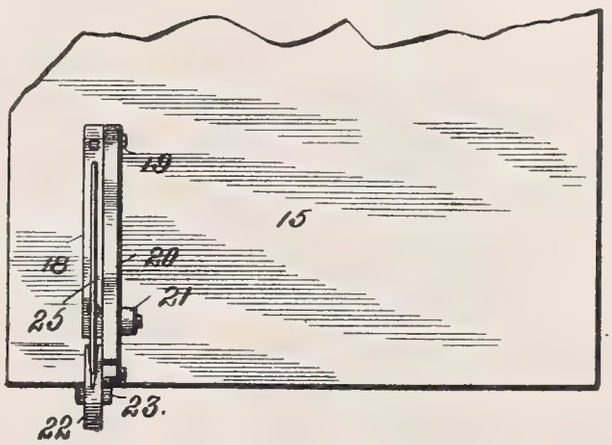
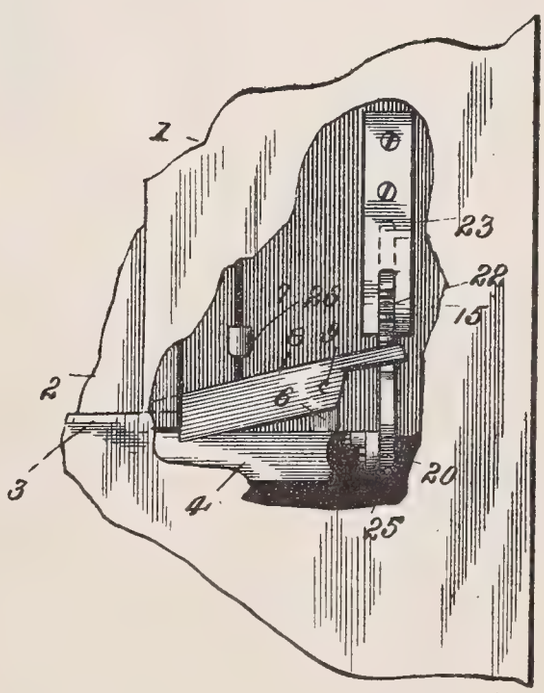


Fig. 5.



Witnesses
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H. E. Clendaniel

Inventor
Wellington P. Kidder
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Attorney

(No Model.) 3 Sheets—Sheet 2.

W. P. KIDDER.

SAFETY DEVICE FOR ELEVATORS.

No. 543,153. Patented July 23, 1895.

Fig. 3.

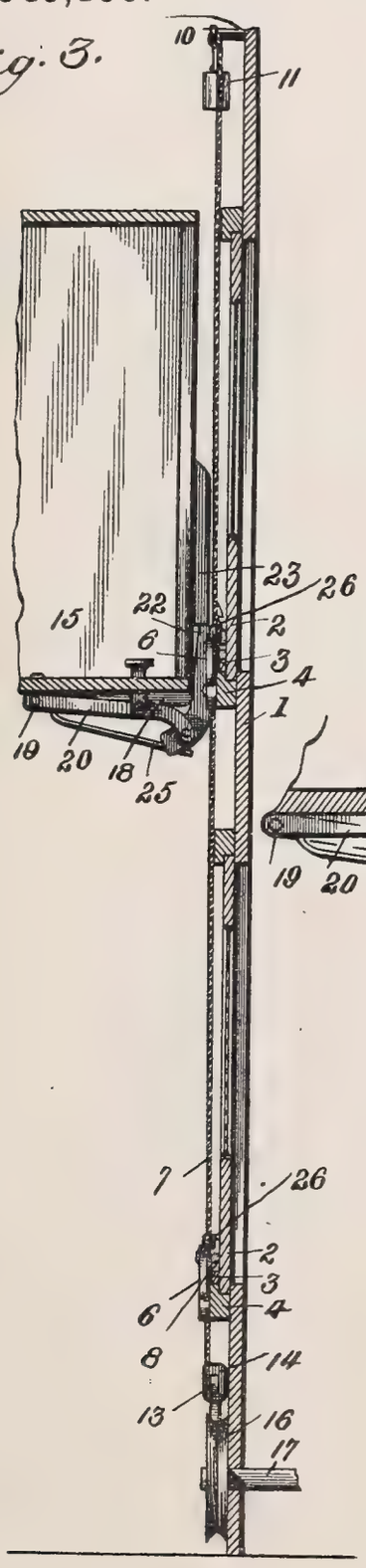


Fig. 8.

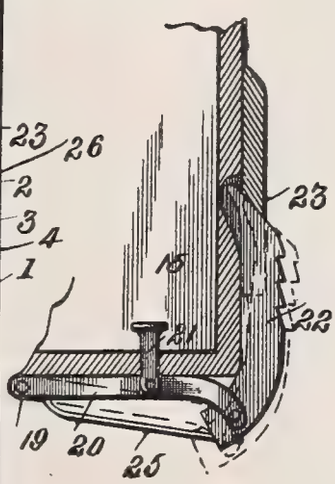
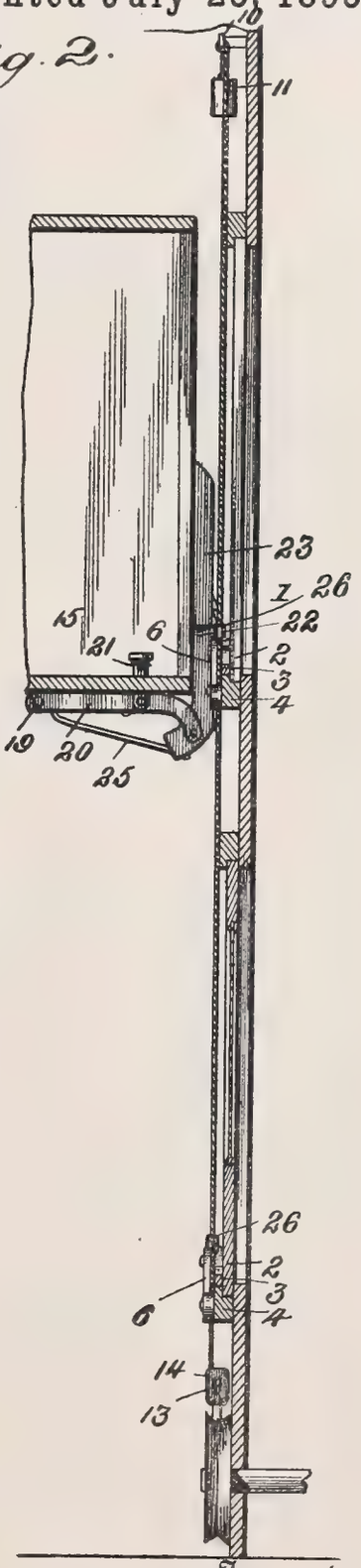


Fig. 2.



Witnesses
John Munie
W. E. Clendaniel

Inventor
Wellington P. Kidder
By T. J. W. Roberson
Attorney

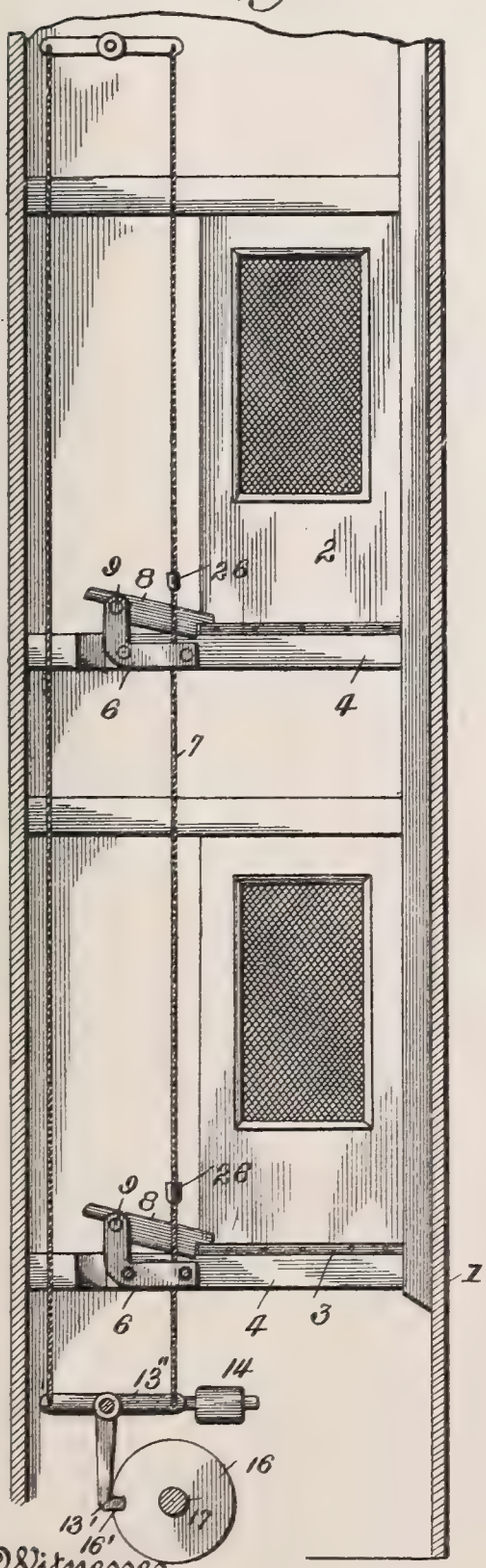
(No Model.) 3 Sheets—Sheet 3.

W. P. KIDDER.

SAFETY DEVICE FOR ELEVATORS.

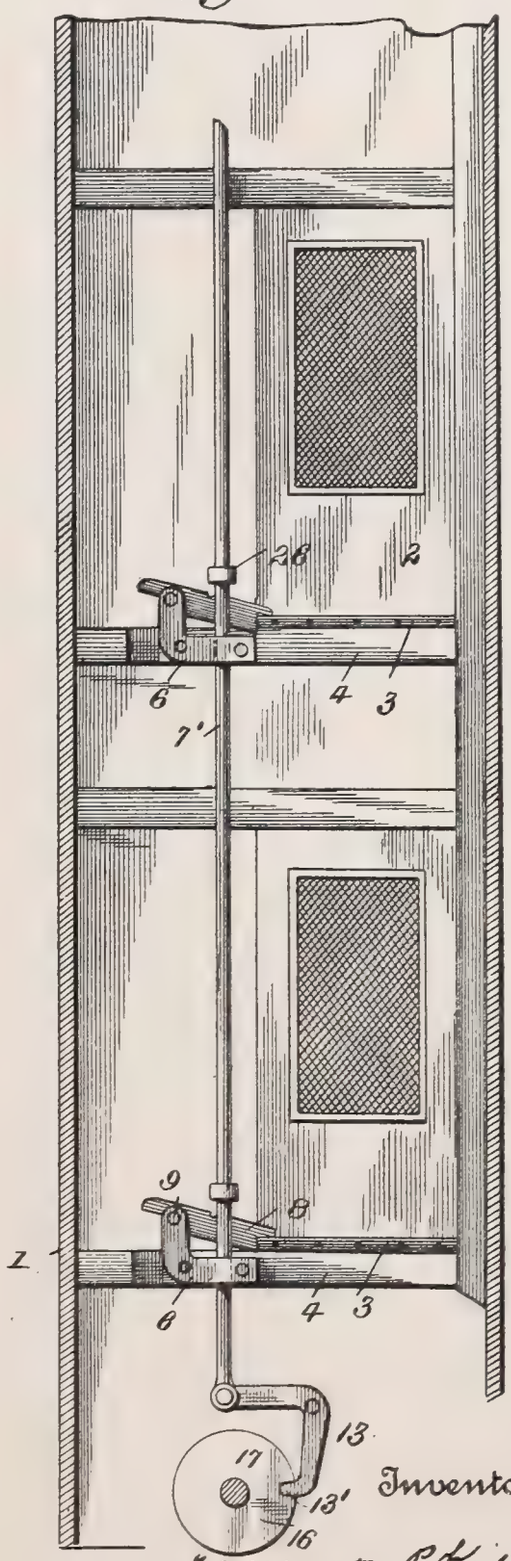
No. 543,153. Patented July 23, 1895.

Fig. 6.



Witnesses
Thos. Donnie
W. E. Clendaniel.

Fig. 7.



Inventor
Wellington P. Kidder
By T. J. W. Robertson
Attorney

UNITED STATES PATENT OFFICE.

WELLINGTON P. KIDDER, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE KIDDER ELEVATOR INTERLOCK COMPANY, OF NEW YORK, N. Y.

SAFETY DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 543,153, dated July 23, 1895.

Application filed May 8, 1895. Serial No. 548,596. (No model.)

To all whom it may concern:

Be it known that I, WELLINGTON P. KIDDER, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented a certain new and useful Improvement in Safety Devices for Elevators, of which the following is a specification, reference being had to the accompanying drawings.

This improvement relates to that class of safety devices for elevators wherein the hoisting apparatus cannot be set in motion while a well-door is open, nor a well-door opened while the car is in motion; and its object is to provide a device of this kind which will be very reliable, cheaply made, easily applied, and not likely to get out of order.

To these ends the invention consists in the mechanism hereinafter more particularly described and then definitely claimed at the end hereof.

In the accompanying drawings, Figure 1 represents a vertical section of an elevator well and car provided with my improvement and with part of the front of the car broken away. Fig. 2 is a vertical section on the line *x x*, Fig. 1. Fig. 3 is a similar section with some of the parts in a different position. Fig. 4 is a bottom plan of the car. Fig. 5 is an elevation of part of the front of the car. Figs. 6 and 7 are modifications which will be more fully described hereinafter. Fig. 8 is an enlarged detail of a latch-operator.

Referring now to the details of the drawings by figures, 1 represents the well provided with doors 2, each having a bar or projection 3 thereon and sliding on guides 4. Fastened by screws or otherwise to the lower guides are L-shaped brackets 6, the horizontal part forming a guide for a wire or rod 7, hereinafter further described, and a support for a door-fastener or a latch 8 pivoted at 9 to the vertical part of the bracket 6, and normally dropping behind the end of the bar 3, whereby the door is prevented from being opened as long as the latch is down, as shown in the lower part of Fig. 1.

The wire or rod 7 may be suspended from a lever 10, from the opposite end of which hangs a weight 11 to keep the wire taut, or a spring 12 may be employed for the same purpose, or both weight and spring may be used if preferred. The lower end of the wire is connected to a bell-crank lever 13, carrying a weight 14, which should be heavy enough to overcome the weight 11 or spring 12, or both of them if both are employed. The lower end of the lever forms a detent 13′, which engages with a notch 16′ in the pulley 16, which represents the ordinary pulley commonly used to move the valve shaft or stem 17. These two coacting parts—the detent and the notched pulley—thus form a lock, as they prevent any movement of the valve.

Attached to the bottom of the car 15 is a block 18, and pivoted at 19 to said block is a lever 20, carrying a foot-piece 21 and a catch 22, both pivoted to said lever, as shown. The upper end of the catch 22 works in a guide 23 and is toothed, as shown at Fig. 8. Its lower end is acted on by a spring 25, the fixed end of which is secured to the block 18.

Firmly secured to the wire 7 in any convenient manner are blocks 26, one at each door, and they are so arranged that when a latch is lifted, so as to allow a door to open, said latch bears on the under side of the block just above it and moves the wire upward.

The operation is as follows: Supposing the car is just about to stop or has stopped, the operator presses his foot upon the foot-piece 21, which depresses the lever 20 and the catch 22, causing one of the teeth of the latter to catch on the short end of the latch 8, and thus through the block next above it, raising the wire 7, which will operate the bell-crank lever 13, and cause the detent 13′ to enter the notch 16′ in the pulley or disk 16, and thus lock the valve shaft or stem from turning. When in this position, the well-door opposite the car can be opened, and when opened the bar or stop 3 will hold the latch 8 in its raised position, which in turn will keep the wire 7 raised, and the latter will hold the detent 13′ in the notch 16′ in the pulley 16, so that as long as the door is open the valve of the hoist-

ing apparatus cannot be operated, but when the door is closed the latch will descend, thus allowing the detent 13′ to leave the notch 16′ under the force of the weight 14.

From the foregoing it will be seen that this apparatus forms a perfect lock for the valve, the movement of which is governed entirely by the position of the well-doors, so that the valve cannot be operated while a well-door is open; nor can any well-door be opened unless the car is opposite said door and the valve is in the closed position, for if an attempt be made to open a well-door when the valve is open and the car in motion the detent 13′ will come in contact with the periphery of the pulley and will thus be prevented from moving sufficiently to allow of the opening of the door, and perfect safety is thus secured under all circumstances.

Instead of the weight or spring for keeping the wire taut, I may sometimes use a return-wire, as shown in Fig. 6, in which case a T-shaped lever 13″ will have to be used, or instead of a wire I may use a stiff rod 7′, as shown in Fig. 7.

Instead of making the notch 16′ in the ordinary pulley on the valve-stem, I may use a separate disk or casting of suitable form connected with said shaft. For convenience in drawing the claims, I shall call said pulley or disk and the coacting detent a "valve-lock," for, as before stated, they constitute a lock that prevents the valve from being moved, meaning to include in said term not only the usual pulley on the valve shaft or stem, but any device connected with said valve shaft or stem by which the valve is locked fast by the coaction of said device and a detent controlled by the position of a well-door.

It is obvious that the wire shown in Fig. 1 and the rod shown in Fig. 7 both operate the detent by tensile strain, and that stiffness is not required, but either will accomplish the desired object, and not only may a wire or rod be employed, but a rope or chain, also, although I prefer a wire. In view of this and in order to cover either form of device for operating the detent, I shall in the following claims refer to the wire or rod as a "detent-operator," except in specific claims, where the "wire" may be specially mentioned, and mean to include in such term either a wire, rod, rope, chain, or equivalent device.

What I claim as new is—

1. The combination in an elevator and with a well-door and the valve mechanism thereof, of a door-fastener, a valve-lock operating directly upon said valve mechanism and independent of the operating rope, and intermediate connections between the valve-lock and door-fastener for holding the valve locked when the fastener is in position to allow the door to be opened, substantially as described.

2. The combination in an elevator and with a well-door and the valve mechanism thereof, of a door-fastener, a valve-lock operating directly upon said valve mechanism and independent of the operating rope, intermediate connections between the valve-lock and door-fastener for holding the valve locked when the fastener is in position to allow the door to be opened, and a car provided with means for operating the door-fastener, substantially as described.

3. The combination in an elevator and with a well-door and the valve mechanism thereof, of a door-fastener, a valve-lock operating directly upon said valve mechanism and independent of the operating rope, intermediate connections between the valve-lock and door-fastener for holding the valve locked when the fastener is in position to allow the door to be opened, and a car provided with means operated by the foot for operating the door-fastener, substantially as described.

4. The combination in an elevator and with a well-door and the valve-operating mechanism thereof, of a door-fastener, a valve-lock, intermediate connections between the valve-lock and door-fastener for holding the valve locked when the fastener is in position to allow the door to be opened, a car, a foot-lever thereon, and a notched catch carried and operated by said foot lever and operating on the fastener, substantially as described.

5. The combination in an elevator and with the well-door and the fastener thereof, of a car, a foot-lever and a toothed catch for operating the fastener, substantially as described.

6. The combination in an elevator and with a well-door and the valve-operating mechanism thereof, of a door-fastener, a valve-lock, intermediate connections between the valve-lock and door-fastener, and a projection on the well-door to hold the fastener in a raised position, substantially as described.

7. The combination in an elevator and with a well-door and the valve-operating mechanism thereof, of a door-fastener, a valve-lock, intermediate connections between the valve-lock and door-fastener, a projection on the well-door to hold the fastener in a raised position and the locking device in engagement, substantially as described.

8. The combination in an elevator and with a well-door and the valve mechanism thereof, of a door-fastener, a valve-lock operating directly upon said valve mechanism and independent of the operating rope, a detent-operator moved by said fastener and operating the valve-lock, substantially as described.

9. The combination in an elevator and with a well-door and the valve-operating mechanism thereof, of a door-fastener, a detent-operator moved by said fastener, and a detent connected with the detent-operator, and a disk on the valve-shaft or stem having a notch to receive the detent, substantially as described.

10. The combination in an elevator and with

the well-doors and car thereof, of a wire 7 running parallel with said doors, blocks 26 on said wire, latches 8 for fastening the doors closed operated by said blocks, a tension device for keeping the wire taut, a lever 13 provided with a detent 13′, and a disk 16 on the valve-shaft having a notch 16′ to receive the detent, all substantially as described.

In testimony whereof I affix my signature, in the presence of two witnesses, this 27th day of April, 1895.

WELLINGTON P. KIDDER.

Witnesses:
WILLIAM J. MILLER,
R. S. BARROWS.

(No Model.) 9 Sheets—Sheet 1.

C. A. HARKNESS.

ELEVATOR.

No. 553,064. Patented Jan. 14, 1896.

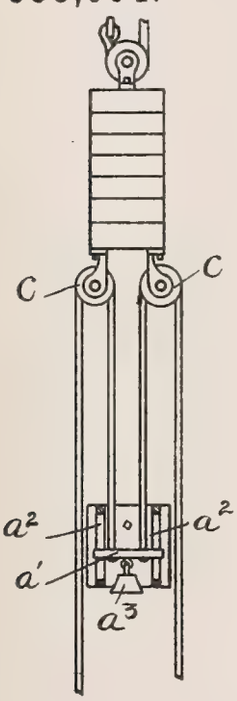
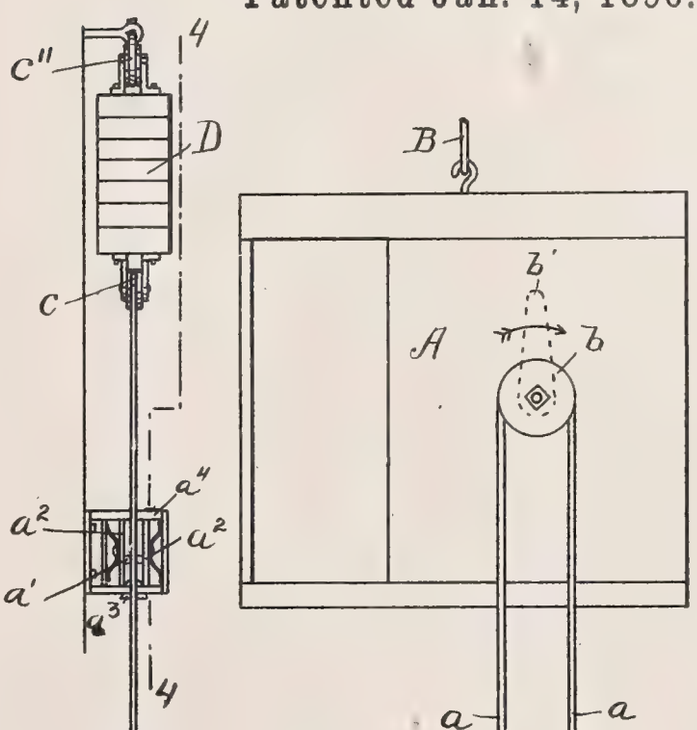


Fig. 3.



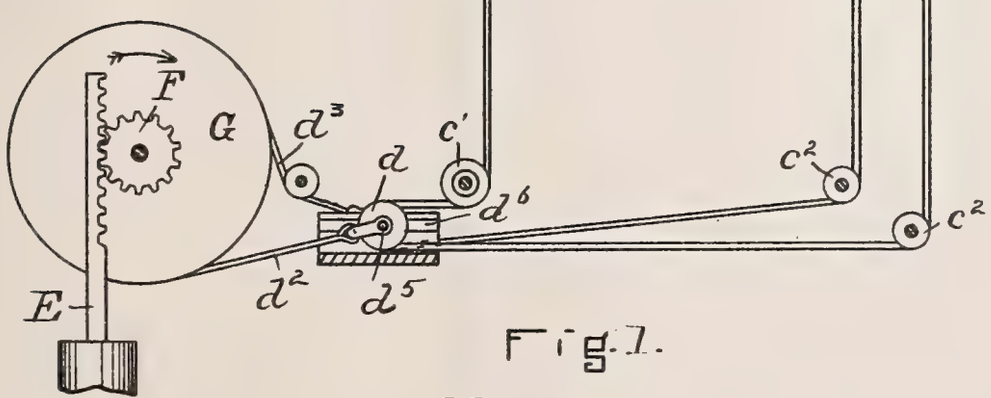


Fig. 1.

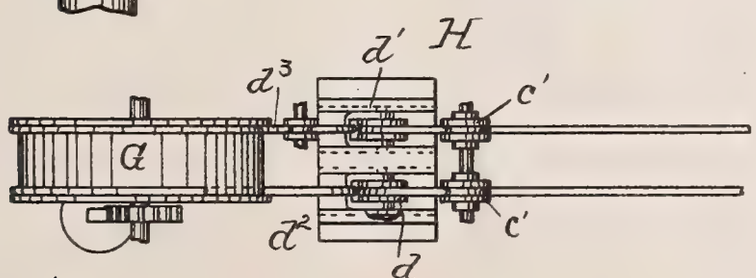


Fig. 2.

WITNESSES.
Matthew M. Blunt.
C. C. Stecher

INVENTOR.
Chas. A. Harkness.
By
Thomas Crosby ATT'Y.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 9 Sheets—Sheet 2.

C. A. HARKNESS.

ELEVATOR.

No. 553,064. Patented Jan. 14, 1896.

Fig. 5.

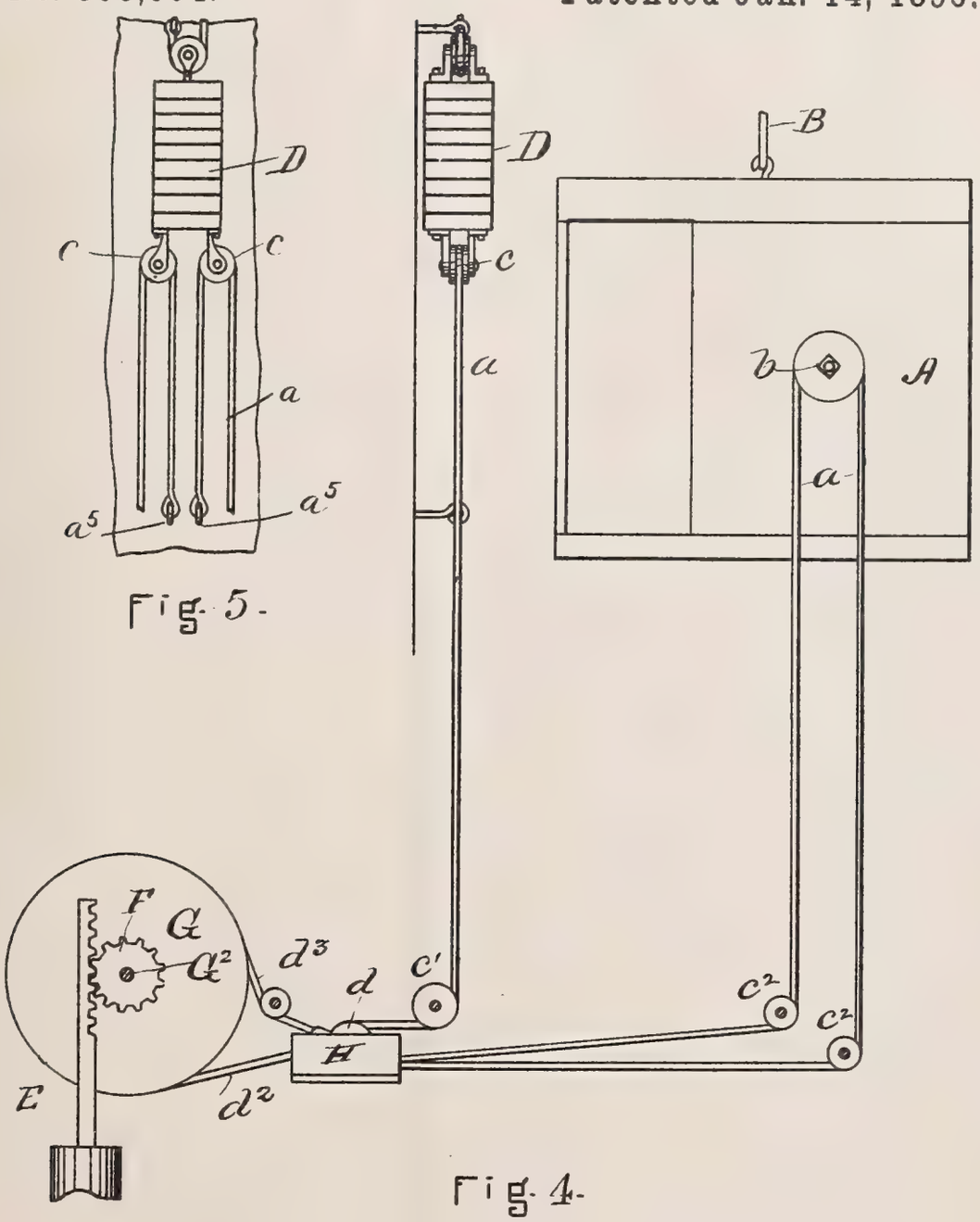


Fig. 4.

WITNESSES.
Matthew M. Blunt.
C. C. Stecher.

INVENTOR.
Chas. A. Harkness
By
Wm. W. Frazier,
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THE NORRIS PETERS CO., PHOTO-LITHO, WASHINGTON, D. C.

(No Model.) 9 Sheets—Sheet 3.

C. A. HARKNESS.

ELEVATOR.

No. 553,064. Patented Jan. 14, 1896.

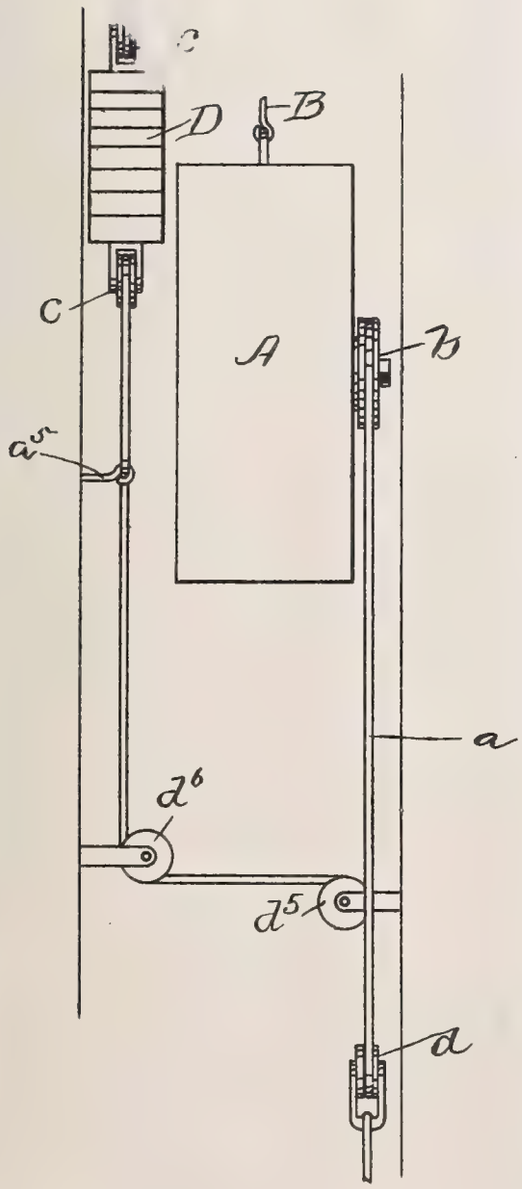

Fig. 7.

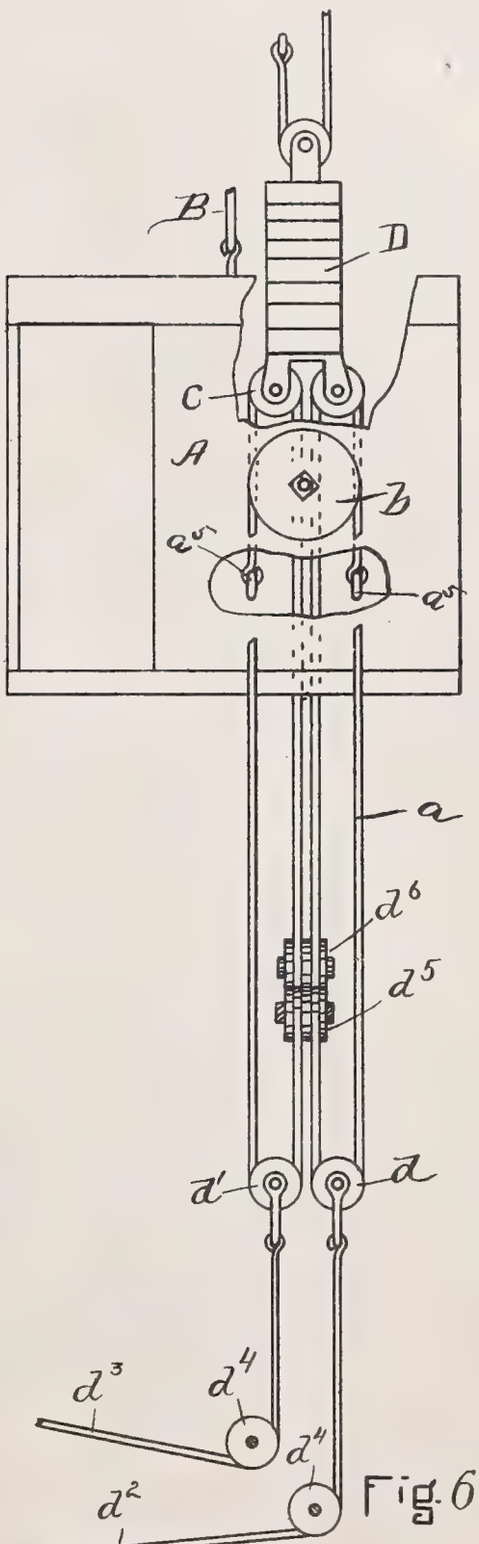

Fig. 6.

WITNESSES.
Matthew M. Blunt.
E. C. Stecher.

INVENTOR.
Charles A. Harkness,
By
Arthur O. Grossley.
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THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 9 Sheets—Sheet 4.

C. A. HARKNESS.

ELEVATOR.

No. 553,064. Patented Jan. 14, 1896.

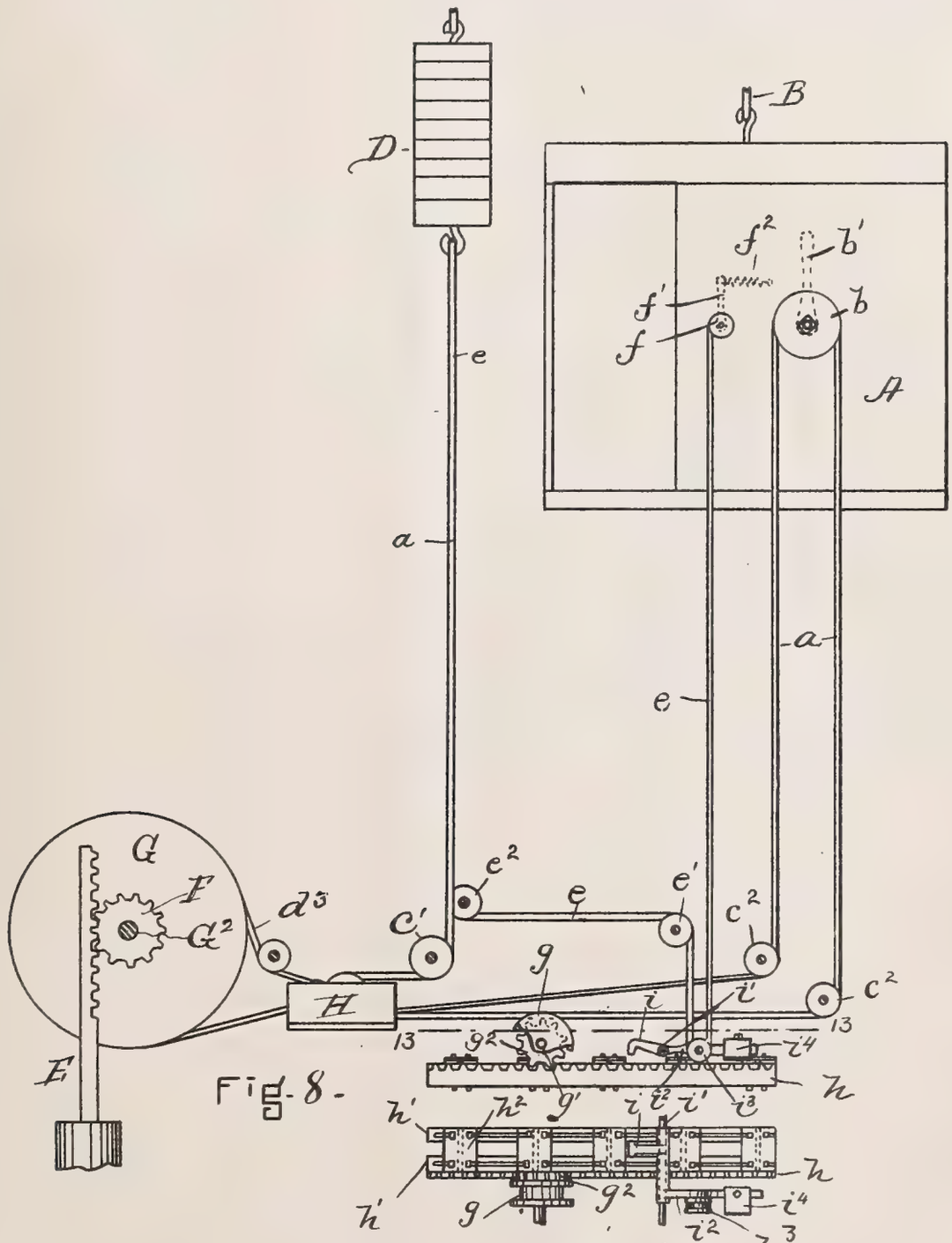

Fig. 8.

Fig. 9.

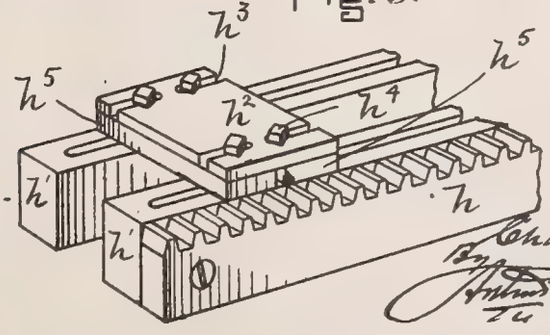

Fig. 10.

WITNESSES.
Matthew M. Blunt.
C. C. Stecher.

INVENTOR.
Chas. A. Harkness
By Arthur Wrasley.
Atty.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 9 Sheets—Sheet 5.

C. A. HARKNESS.

ELEVATOR.

No. 553,064. Patented Jan. 14, 1896.

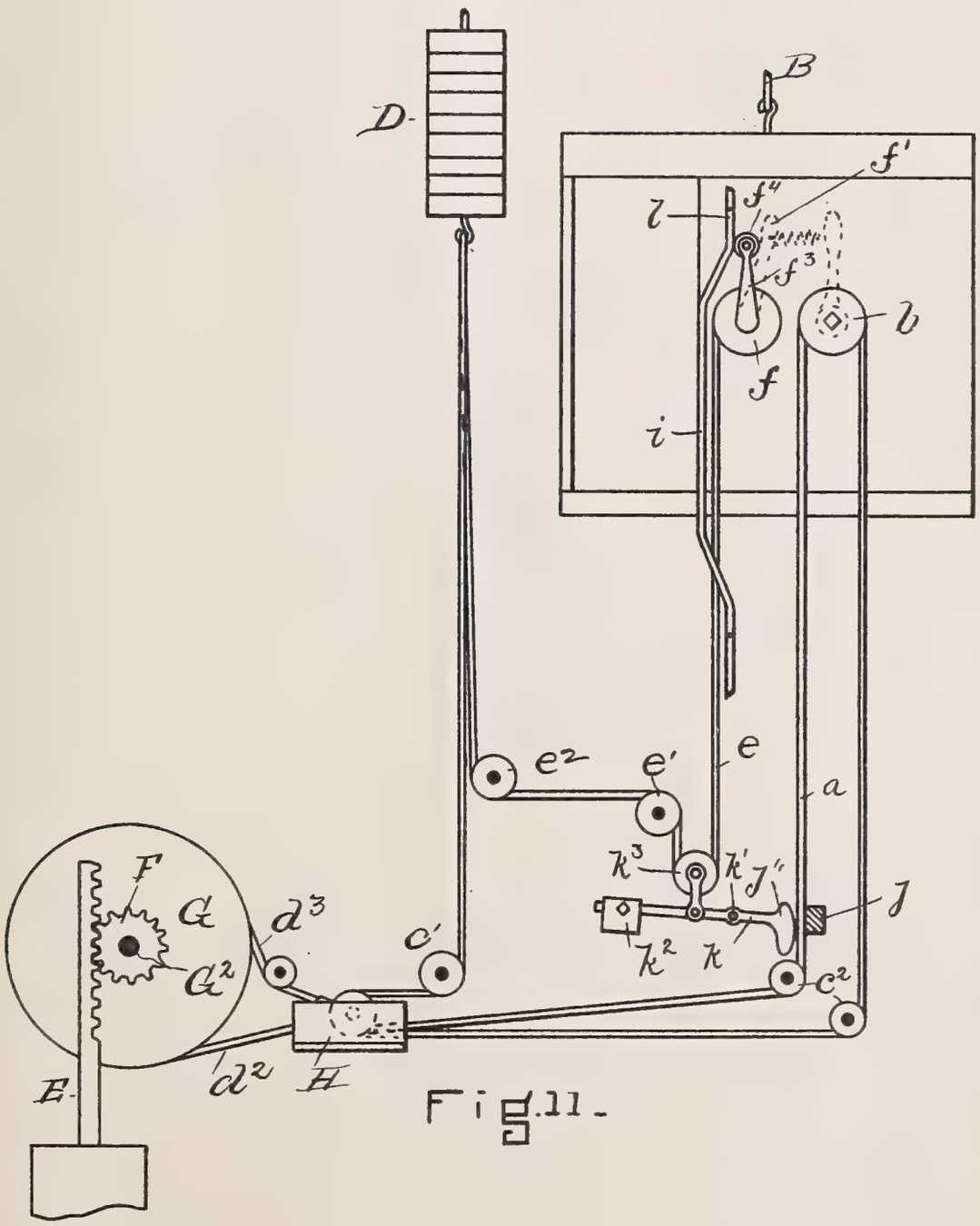

Fig. 11.

WITNESSES.
Matthew M. Blunt.
C. C. Stecher.

INVENTOR.
By Chas. A. Harkness.
Arthur W. Crosley, ATT'Y.

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(No Model.) 9 Sheets—Sheet 6.

C. A. HARKNESS.

ELEVATOR.

No. 553,064. Patented Jan. 14, 1896.

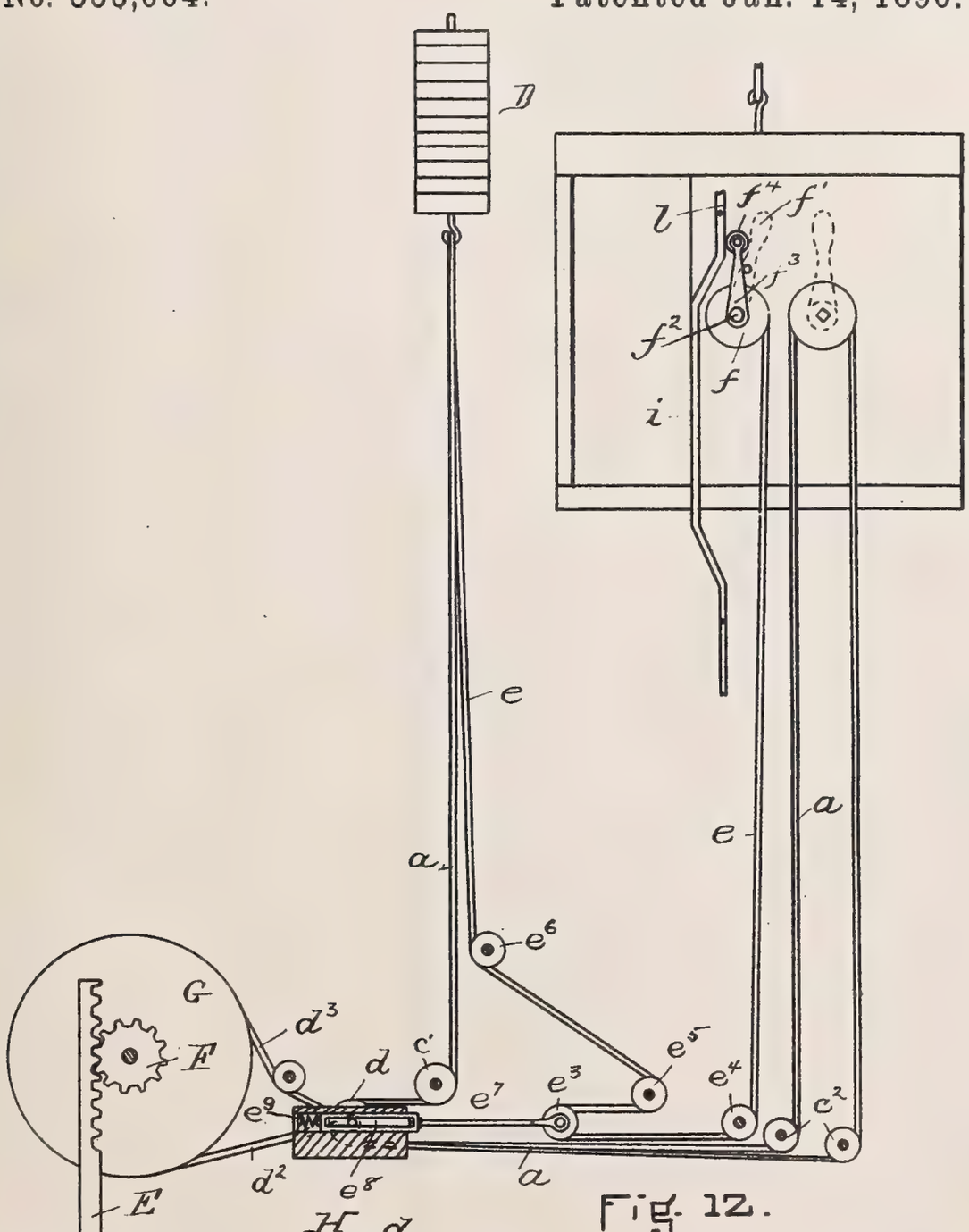

Fig. 12.

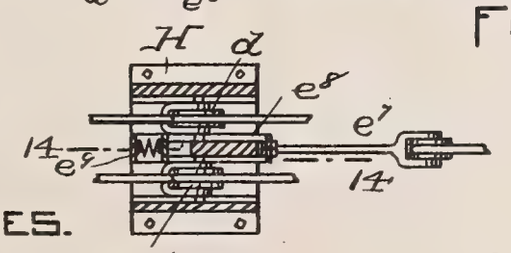

Fig. 13.

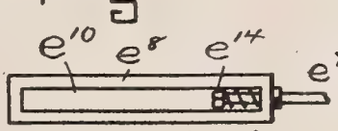

Fig. 14.

WITNESSES.

Matthew M. Blunt.

Marcus Bells.

INVENTOR.

Charles A. Harkness

By

Wilfred W. Frisbey,

Atty.

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(No Model.) 9 Sheets—Sheet 7.

C. A. HARKNESS.

ELEVATOR.

No. 553,064. Patented Jan. 14, 1896.

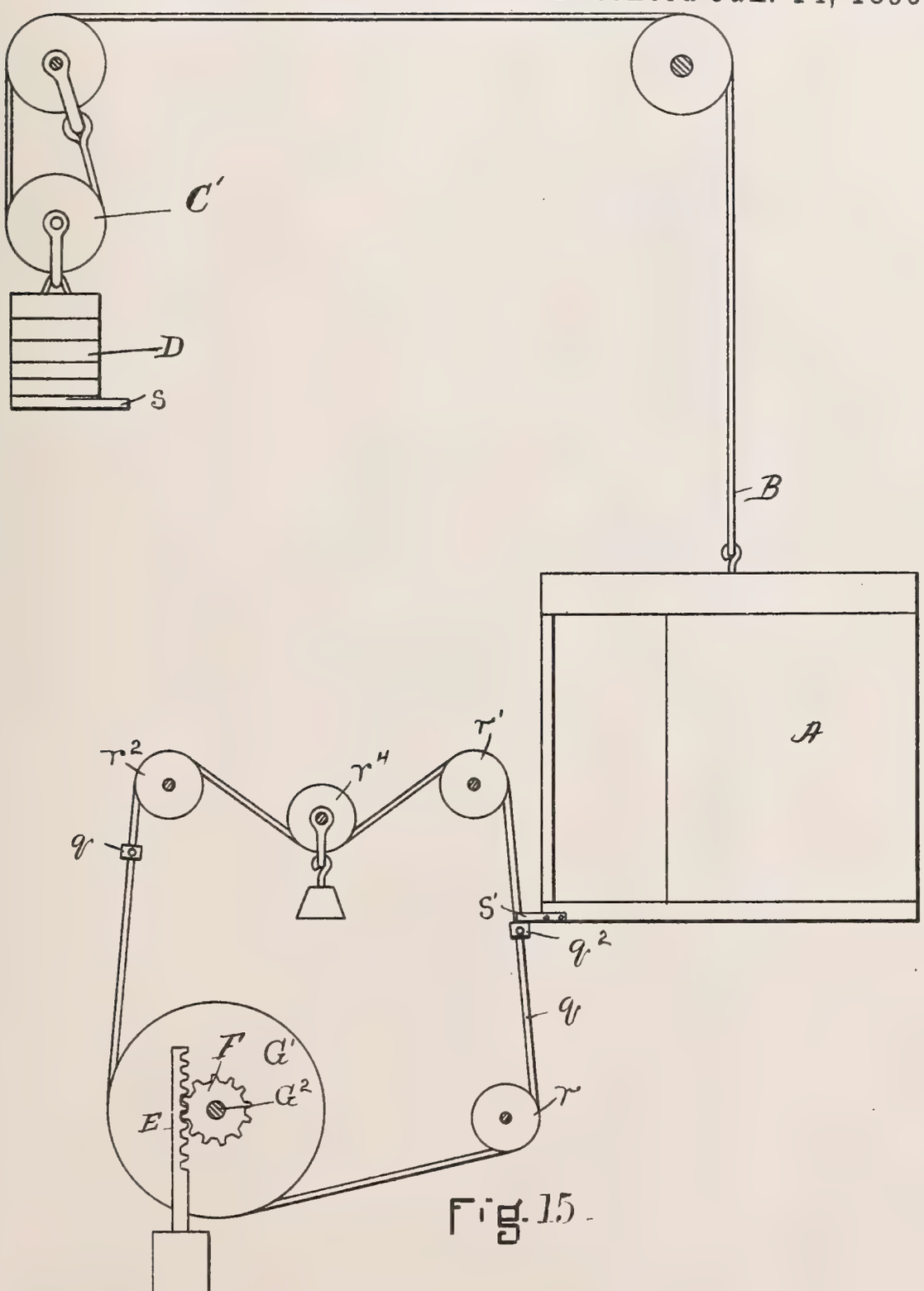

Fig. 15.

WITNESSES

Matthew M. Blunt.

C. C. Stecher

INVENTOR.

Chas. A. Harkness.

By Arthur W. Crossley, ATT'Y

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 9 Sheets—Sheet 8.

C. A. HARKNESS.

ELEVATOR.

No. 553,064. Patented Jan. 14, 1896.

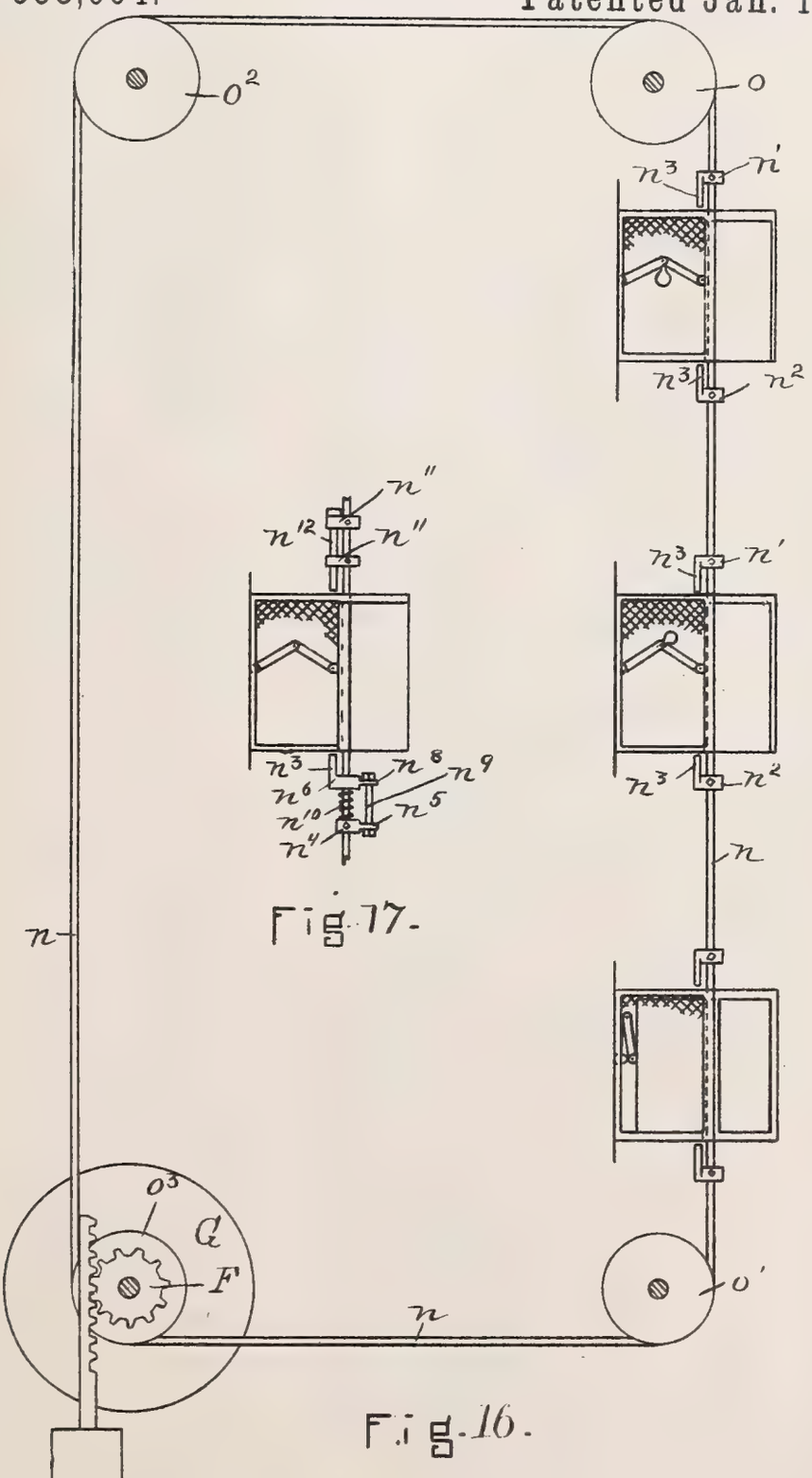

Fig. 17.

Fig. 16.

WITNESSES.
Matthew M. Blunt
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By Chas. A. Harkness.
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No Model.)

9 Sheets—Sheet 9.

C. A. HARKNESS.

ELEVATOR.

No. 553,064. Patented Jan. 14, 1896.

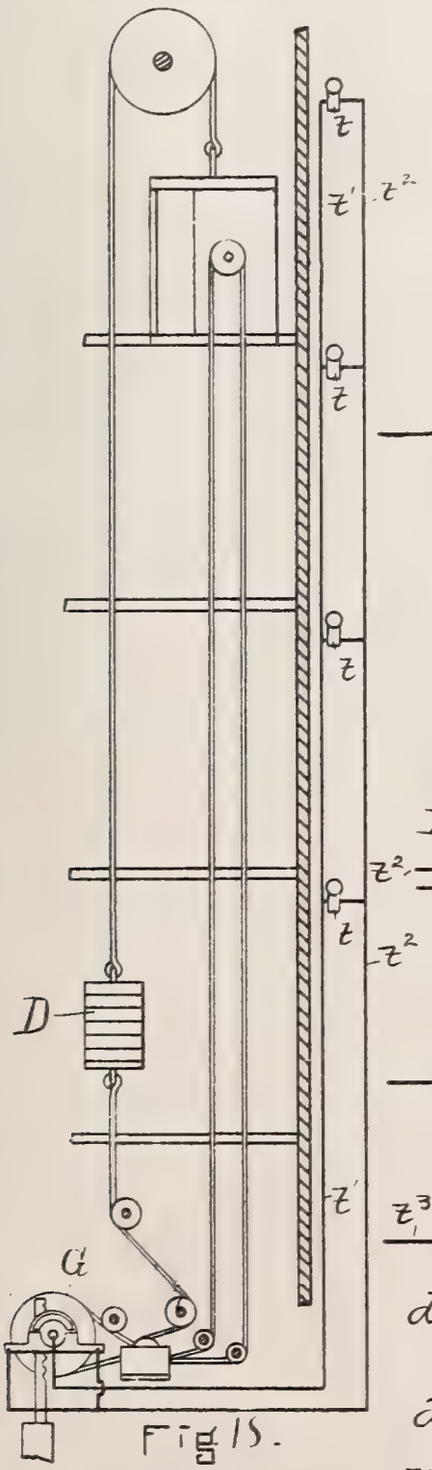

Fig. 15.

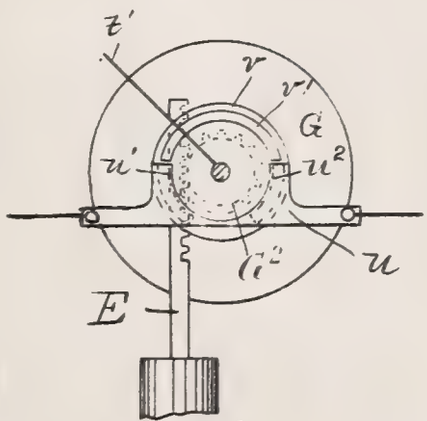

Fig. 19.

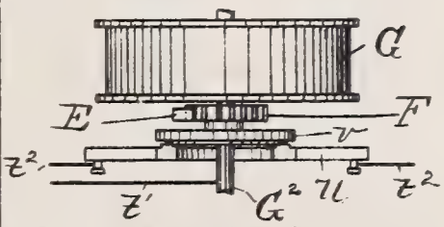

Fig. 20.

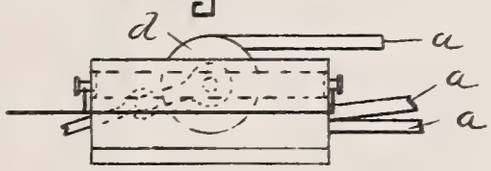

Fig. 21.

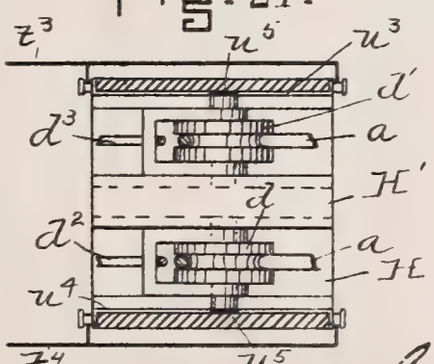

Fig. 22.

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UNITED STATES PATENT OFFICE.

CHARLES A. HARKNESS, OF PROVIDENCE, RHODE ISLAND.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 553,064, dated January 14, 1896.

Application filed February 8, 1895. Serial No. 537,710. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. HARKNESS, of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Elevators, of which the following is a specification.

My invention relates to certain new and useful improvements in elevators and devices for controlling the movements thereof.

Among the various objects of the invention are, first, the providing of certain connections between the cage and valve moving devices whereby the said valve-moving devices will be sensible of the slightest movement of the operating-rope; second, the provision of a manipulating or operating rope which will not be subjected to any vibrations or jerks resulting from the stopping or starting of the cage; third, the provision of means to compensate for the slightest lengthening or shortening of the operating-rope; fourth, the provision of means supplemental to the operating-rope for effecting the movements of the cage and for stopping it, either at will or automatically; fifth, the provision of means supplemental to the operating-rope for stopping the movements of the cage when it has reached the highest or lowest point in its travel; sixth, the provision of means whereby all the doors leading into the well are automatically locked against movement during the travel of the cage and can be opened only when the cage is at rest at predetermined points; seventh, the provision of means for locking the cage against movement while the door is open; eighth, the provision of means for audibly notifying persons on various floors when the cage is in motion, and, ninth, the provision of other novel features of construction and arrangement of parts for the perfection of an elevator, as will hereinafter be described and pointed out.

Reference is to be had to the annexed drawings and to the letters marked thereon, forming a part of this specification, the same letters designating the same parts or features, as the case may be, wherever they occur.

Figure 1 is a side view of an elevator-cage, showing one way of arranging the operating-rope and connecting it with the counterweight. Fig. 2 is a plan view showing the operating-rope and the drum for shifting the valve. Fig. 3 is a front elevation, partly in section, of the compensating devices for the operating-rope. Figs. 4 and 5 show the operating-rope as having its ends rigidly secured to the wall of the well. Figs. 6 and 7 show the operating-rope as secured to the counterweight and operating the valve-drum by supplemental ropes. Fig. 8 is a view showing in detail the supplemental rope for effecting the opening and closing of the valve when the cage is at predetermined points. Fig. 9 is a plan view of the rack and appurtenances. Fig. 10 is a perspective view of a part of the same. Fig. 11 shows a modification in respect to the supplemental means for effecting the stoppage of the cage. Figs. 12, 13, and 14 show a modified means for stopping the travel of the cage. Fig. 15 shows in detail an arrangement whereby the valve is automatically operated by the cage and by the counterweight, respectively, when the cage has reached its lowest and highest points of travel. Fig. 16 shows an arrangement of parts whereby all of the corridor or landing doors are simultaneously locked and unlocked against movement at predetermined times. Fig. 17 shows a slight modification in respect to the locking means that are employed in the construction shown in Fig. 16. Fig. 18 is a diagrammatic view showing the buzz for notifying persons of the moving of the cage. Figs. 19, 20, 21, and 22 show the means for closing the electric circuit whereby the buzz is sounded.

Referring to the drawings, the cage is uniformly designated by A, it being one of the ordinary types, suspended in the usual way upon the end of a flexible cable, chain, or other suspensory B, which latter passes over sheaves (see Fig. 15) and has its opposite end secured to a stationary point, there being a counterweight D hung from a sheave C' suspended from the cable B. The cage may rise and fall in suitable guides and its movement may be effected by a motor of any of the ordinary kinds now commonly used. I have conventionally illustrated at E a valve-rod which may be connected to a change or reversing valve controlling a steam or hydraulic cylinder and piston for operating mechanism by which the cage is raised and lowered. If desired, an electric motor controlled by said rod may be used. The rod E is provided with rack-teeth

at one side with which mesh the teeth of a pinion F rigid with a drum G on a shaft G^2.

The rod, the pinion, and the drum, which are shown as one form of stop and start mechanism for the motor, may be varied to suit the particular form of motor that it may be desired to employ.

Heretofore the valve has been operated in some cases by an endless rope, traveling with the cage and connected directly with the counterweight, and passing around operating-sheaves at the bottom of the well. This is an excellent arrangement, as it takes all longitudinal strain off the operating-rope, and yet it is not applicable to the many elevator apparatuses in which the counterweight is so arranged, by doubling the suspensory, as to run but half the travel of the car. Hence, by my improvements, the operating-rope is passed around a pulley on the counterweight, and has its ends secured to the well or hatchway wall, so that although the suspensory be doubled, yet the shortened travel of the counterweight is compensated for.

The operating or valve-controlling rope is indicated by *a*, and passes around a hand-controlled wheel *b* on the cage. This wheel may be operated in any convenient way and may be provided with devices for holding it stationary at any point in its revolution. The rope *a* has its ends secured to the well-walls, as in Figs. 4 and 5, or to a weight sliding in guides on the well-wall, as illustrated in Figs. 1 and 3, from whence they pass over small sheaves *c c* depending from the counterweight D, thence downward around stationarily-mounted sheaves *c' c'*, under sheaves c^2 c^2 and around the wheel *b*. When the cage is moving upward, the counterpoise will move downward a distance half that traversed by the cage, so that the rope is free to move with the cage under the sheaves *c' c²*.

One half of the rope *a* passes around a pulley *d* and the other around a pulley *d'*, the said pulleys *d' d* being each secured to the end of the valve-operating means which, in this case, are ropes secured to the drum *g*. The pulleys *d d'* are mounted on shafts d^5 which slide transversely of their axes in grooves d^6 in a guide-frame H, which is secured to the floor in any suitable way. This guide-frame H will be hereinafter further described in connection with Figs. 13 and 14.

One rope d^2 passes in one direction around the drum and the other d^3 around the drum in the other direction, so that if one rope is subjected to a longitudinal pull the drum will be rotated in one direction, and if the other rope is pulled the drum will be rotated in the other direction, so that the valve will be either opened or closed, as the case may be. Thus, if the hand-controlled wheel *b* be rotated in the direction of the arrow, the left-hand side of the rope *a* will be taken up (the right-hand side being paid out in accordance therewith) so that the pulley *d'* is drawn forward and the pulley *d* is drawn backward, thereby causing the drum G to be rotated in the direction of the arrow and the rod E to be moved upward. The rope *a* moves freely past the pulleys when the cage is in motion, yet the latter are sensitive to the slightest movement of the hand-controlled wheel *b*.

In order to compensate for any longitudinal movement of the ends of the rope *a*, I may attach them to a cross-bar *a'* which lies between four upright spring-pressed bars a^2. A weight a^3 is attached to the cross-bars *a'* so as to keep the rope *a* taut. The spring-pressed bars are mounted in a frame a^4, which latter is secured to one of the walls of the well.

It is apparent that, if desired, as heretofore stated, the rope *a* may have its ends secured by eyebolts a^5 to the walls of the well, as illustrated in Figs. 4 and 5.

Referring to Figs. 6 and 7, it will be seen how the rope *a* may be materially shortened. The ropes d^2 and d^3, or chains if desired, which are secured to the drum, (not shown,) are of considerable length and pass around pulleys d^4 in the bottom of the well. The rope *a* passes down around the pulleys *d d'*, thence upward over pulleys d^5, under pulleys d^6, up over pulleys *c c* on the counterweight D and having its ends finally secured to the eyebolts a^5. In all of these figures the line *a* is what is termed a "running rope"—that is, a rope which travels with the car, in contradistinction to a "standing line," or a line relatively to which the car travels.

It is well known to those practically acquainted with elevators that it is frequently impossible to stop the elevator at the proper point, and that when the cage is traveling at a high rate of speed the machinery is subjected to sudden and severe strains when it is desired to stop its ascent or descent by means of the operating-rope, and the passengers subjected to a disagreeable shock when the cage is brought to a sudden rest. Hence I employ a flexible means supplemental to the hand-operating devices for automatically stopping the car at predetermined points. I have shown several mechanisms for accomplishing this purpose, they being illustrated in Figs. 8 to 14.

Referring first more particularly to Figs. 8 to 10, *e* is a single rope having one end secured to a wheel *f* on the cage, which latter is rotated by means of a lever *f'*, as shown in dotted lines. The other end of the rope *e* is secured to the counterweight D so that as one end rises the other end falls, and vice versa, the rope passing around pulleys *e' e²* secured to the well-walls near the bottom thereof. The rope *a* has one-half passed around a drum *g* which is mounted on a shaft *g'* journaled in any suitable bearings in the cellar or in the bottom of the well. A pinion g^2 is keyed or otherwise secured to shaft *g'*, and meshes with a rack-bar *h* which slides in suitable guides. (Not shown.)

It will be seen that if rope *a* is drawn in one direction the rack-bar will be moved by the

drum and pinion in the other direction, and vice versa. The rack-bar is secured to parallel side bars h' provided with cross-pieces h^2 corresponding to the number of landings at the side of the elevator-well.

i is a dog pivoted on a cross-shaft i' and lying above the path of the cross-bars h^2 h^2. The dog is provided with an extension i^2 on which is journaled a loose pulley i^3, and which is also provided with a weight i^4, the purpose of which weight is to overcome the tendency in the sudden starting of the car to throw the dog into engagement with the cross-bar h^2. The rope e passes from the pulley i^3 and up over the pulley e', so that if the lever f' be moved to the right the rope will be wound on the wheel f, thereby lifting pulley i^3 and throwing the dog i down, so that it will engage with the next cross-piece h^2 as the side bars move past. This stops the movement of the rack-bar and prevents the pinion g^2 and drum g from rotating, but as the cage and counterweight still continue to move, one valve-controlling pulley d will be drawn forward and the other drawn back, so that the drum G is rotated in one direction or the other and the valve shifted. The pinion, rack, and cross-bars are so related to the travel of the cage that the cross-bars correspond to the landings and stop the elevator at the proper place. The cross-bars are made adjustable, each being provided with slots h^3 through which bolts h^4 pass into cross-bars h^5 h^5, (see Fig. 10,) and into the parallel side bars h' h'. The cross-bars h^5 h^5 can be moved apart and secured in place at any points relatively to each other and to the iron bar h^2 by the bolts h^4. A counterbalancing-spring f^2 is employed to make it comparatively easy for the operator to manipulate the lever f' to throw the dog i into the path of the cross-bar h^2.

Referring to Fig. 11, a different mechanism is shown for accomplishing the automatic stopping of the elevator-cage. The rope a passes between stationarily-mounted devices for engaging it, consisting of a stationary bar j suitably mounted in the wall of the elevator-shaft and a clamp j'. The latter is secured to a lever k pivoted at k' and provided with a counterbalancing-weight k^2 and a pulley k^3. The supplemental running rope e is secured to a wheel f and to the counterweight, as in Fig. 8, and causes the stationarily-mounted device j' to engage the rope a, and thereby shift the stop and start mechanism. Rigid with the wheel f is a lever f^3 and an antifriction-wheel f^4, which latter rests against a guide-rail l extending from the top to the bottom of the elevator-well. At each floor it is bent outward, as at l', so that when the cage reaches that point the lever f^3 is pressed outward by the lever f'. the rail permitting it, thereby lengthening the rope e and allowing pulley k^3 to drop, whereby the weight k^2 causes the clamp j' to grip the rope a against the cross-bar j. This draws one pulley d forward and allows the other to move backward, the same as in Fig. 8, thereby shifting the valve.

For the sake of clearness and convenience I have shown a device for clamping but one part of the rope to stop the car in its movement in one direction, but it will be understood that in actual practice I employ two clamping devices, one for each side of the rope, so as to stop the car in either of its movements. In Figs. 12, 13 and 14 I show a slightly-modified device for stopping the car. In this case the rope a passes around the pulleys c^2, d and c', being secured to the counterweight D at its ends. The rope e is secured to the wheel f, which is rigidly mounted on a shaft f^2 projecting through the side of the cage, there being a lever f' secured to the shaft on the inner end thereof for rotating the said shaft and wheel whereby the rope e is drawn in or paid out. The latter passes from the wheel f down under pulley e^4, around the pulley e^8, back around pulley e^5, under pulley e^6 up to the counterweight D. The pulley e^3 is connected through the medium of a link e^7 to one end of a sliding frame e^8, there being a helical spring e^9 to keep the fram drawn back. (See Figs. 12 and 13.) This construction serves, among other things, as a rope-tightener to the rope e—that is, as a means for keeping the rope e taut.

In Fig. 14 I have shown a way in which the spring e^9 may be interposed between a head e^{14} on the end of the link e^7 and the frame e^8 and operate with the same effect as before explained.

The frame e^8 has grooves or slots e^{10} in its sides corresponding to the grooves in the side flanges of the guide-frame H, so that the axles of the pulleys d d' can slide freely back and forth therein as the rope a is drawn in and paid out for shifting the valve-rod or stop-and-start mechanism. When the valve is open, one pulley is in a forward position and the other is some distance behind it, so that when it is desired to close the valve, it is merely necessary to draw the frame forward, and the end walls of the slots e^{10} will cause both pulleys to come to a state of rest in the position shown in Fig. 13, as will readily be understood. The spring e^9 also serves to normally hold the frame e^8 in the position shown in Fig. 13, so that the pulleys d d' are free to slide back and forth for opening the valve.

The frame e^8 constitutes a device for operating the stop-and-start mechanism, and is, as said, provided with a loose pulley e^8, around which the supplemental running line e passes to operate it. In all of these devices it will be observed that I have provided an operative running line connected with the car and coacting with stationarily-mounted devices for operating the stop-and-start mechanism. By "stationarily mounted" I mean that the devices are not connected with the car so as to travel therewith, but are mounted on supports which are stationary; and also that I

have provided means for automatically operating the stationarily-mounted devices when the cage has reached a predetermined point in its travels. In Figs. 11 and 12 the means consists of the offset guide-rail and the lever f^3, and in Fig. 8 it consists of the traveling rack and the dog i. By the said means the cage may be automatically stopped at any landing by the operative drawing upon the lever f', as will be clearly understood; and in Figs. 11 and 12 the supplemental rope is locked against movement relatively to the car, except when the lever f^3 is opposite one of the offsets in the cam track or rail.

I also employ means for locking all the corridor-doors during the movement of the cage, as is illustrated in detail in Figs. 16 and 17. In this instance the means is operated mediately by the operating-rope a through the medium of the drum G and its supporting-shaft, and is so constructed and arranged that when the valve is partially or entirely open locking devices are so shifted that they lie in the path of each door and prevent the movement.

Referring to Fig. 16, it will be seen that a rope or chain n is employed, supplemental to ropes a and e, (not shown,) which passes around a sheave o at the top of the well or hatchway, a sheave o' at the bottom of the well, and a guide-sheave o^2, having the axis substantially in the horizontal plane of the axis of the sheave o. Then the rope has its ends secured to a sheave o^3, which is keyed or otherwise rigidly secured to the shaft, to which drum G is also rigidly secured.

n' n^2 are cable attachments or clips clamped to the rope n, respectively, slightly above and below the upper and lower sills of the corridor-door and lying in the vertical planes of the door. Each attachment or clip is provided with a projection n^3, which moves down into the path of the door-sill when the cable is shifted vertically, so that if the cable moves downward clip n' drops into the path of the door, and if the cable is drawn upward clip n^2 rises with it so as to engage the vertical side bar of the door. Thus the doors are effectually locked against movement when the valve is shifted and the car is in motion.

It sometimes happens that the engineer or mechanic must get into the well or get on top of the cage to repair some parts, and this latter cannot be done unless the top of the cage is below the landing, at which time the door is locked. Hence it is necessary that one or more of the clips be provided with a projection that can be slipped out from behind the door, so as to allow it to be opened.

In Fig. 17 I have shown a lower clip n^4 as being provided with a laterally-extending offset n^5, the clip being rigidly clamped on the cable or rope n. Above the stationary clip n^4 is a vertically-sliding clip n^6, having a projection n^3 for engaging the door, and an offset n^7 similar to that at n^5. The clip n^6 is held in position by a spring n^{10}, there being a bolt n^9, which limits the vertical movement of said clip.

When the cable is moved upward in the operation of shifting of the valve, pin n^3 engages the edge of the door; but it can be moved down out of engagement therewith to open the door when that becomes necessary, the spring forcing it back in place after the door is again shut.

Above the door are two stationarily-secured clips n'' n'', with a freely-sliding bolt or pin, which is held down by force of gravity, so that no spring is needed. When this pin is in engagement with the door by reason of the shifting of the rope n it can be slid up out of engagement with the door by hand.

In order to reduce the travel of the supplemental line the sheave o^3 is of a reduced diameter, so that when the drum is rotated the line will move a distance less than the distance the main rope travels. The parts are so arranged that the supplemental line will move just enough to carry the pins n^3 behind the doors.

In order to prevent too great vertical movement of the cage and prevent any accident which might happen if the operating-ropes a and e should become broken or disabled, I employ means supplemental thereto for bringing the cage to a state of rest at its highest and lowest points of travel respectively. In Fig. 15 such means are illustrated. A rope or chain q is attached to a drum G' supplemental to drum G (not shown in said figure) and rigid with its supporting-shaft G^2. It passes around guide-sheaves r r' r^2 and is kept taut by a weighted pulley r^4. The vertical portions of the rope q are each provided with an attachment or clip q' q^2, with which can alternately engage a projection s' on the cage. When the cage is traveling downward and has nearly reached its lowest point, projection s' will strike clip q^2 and shift the valve-rod in one direction, so as to stop the cage, and a similar thing will happen when projection s on the counterweight D strikes clip q' during the upward movement of the cage.

In addition to the above-described safety devices whereby the corridor-doors are automatically locked I employ other safety devices, consisting of means for audibly notifying waiting passengers of the movement of the car. This may be done by an electric sounding device located on the cage or at the top of the hatchway or well. I prefer in many cases to place a sounding device on each floor, and in Fig. 18 I have shown the device as so placed. The device may consist of a "buzz" or of a bell having a sound different from that of the signal or call bell on the cage. In order that the sounding device may be sounded while the car is in motion, I provide a switch, moved by the operating-rope, for closing the electric circuit in which the sounding device is located.

In Fig. 18 I have illustrated somewhat conventionally an electric circuit and a series of

sounding devices, together with the switch which is operated by the valve-closing devices. Referring to Figs. 19 and 20, f f f are a series of sounding devices connected in multiple arc in a circuit consisting of wires f' f^2. One wire, f', is electrically connected with the shaft which supports the valve-operating drum G, and the other wire, f^2, is connected with a metallic plate u having two arc-like contact-surfaces u u^2. On the shaft G^2 and electrically connected therewith is a metallic disk v having a concentric arc-like contact-surface v'. The contact-surfaces u', u^2 and v' are so related that when the valve is closed they will occupy the position shown in Figs. 19 and 20 and the circuit will be open; but if the drum G is moved in the slightest degree to open the valve the contact v' will engage either contact u or u^2 and the circuit will be closed, thereby causing the buzzes or signals f to sound, which they will continue to do until the valve is closed.

In Figs. 21 and 22 I have shown a modification in which the circuit is closed by the shafts of the pulleys d d'. In this case wire f^3 is connected to a metallic strip u^3, and wire f^4 is connected to a similar strip u^4. At u^5 in each metallic strip is a strip of insulating material. The shafts of wheels d d' are metallic, and rest against the said strips u^3 u^4, except when the valve is closed, when they will rest against the insulating-strip u^5. The inner ends of the axles rest in grooves in a metallic flange H', so that they shall be always in electrical connection.

When the valve is opened by the rope a moving the pulleys d d' the axles of the latter will close the circuit through wire f^3, strip u^3, flange H', strip u^4, and wire f^4, thereby causing the signal to sound.

While I have herein described my invention and parts thereof as embodied in one or several forms, yet it will be understood that I do not limit myself to the devices shown, as many changes may be made without departing from the spirit and scope of my invention.

Whenever I herein use the term "valve-shifting devices" it will be understood that I mean devices for starting and stopping the motor of any kind or type.

I do not herein claim broadly a car-controlling device comprising a controlling-line, a hand device for shifting said line, secondary mechanism for shifting said line to stop the motor, and means to prevent the operation of said secondary mechanism, except when the car is near a landing, as that forms the subject-matter of a claim in my co-pending application, Serial No. 533,652, filed January 2, 1895.

What I claim is—

1. In an elevator apparatus, a cage, a suspensory therefor, a counter-weight, a stop and start mechanism, an operating line connected with the stop and start mechanism, devices on the well wall for compensating for the variations in the length of the line, said line traveling with the car, passing around a pulley on the counter-weight, and having its ends secured to said compensating devices on the wall of the well or hatchway.

2. In an elevator, the combination with the cage, a running operative line traveling therewith, a stop and start mechanism for the motor, and two movable pulleys connected with the stop and start mechanism, and around which the operative line passes, of a supplemental line traveling with the car, for drawing said pulleys to a neutral position to effect a stopping of the car.

3. In an elevator, the combination with the cage, of a stop and start mechanism, a running operative rope, a stationarily mounted device for shifting the operative rope whereby the stop and start mechanism is operated, and said device having a loose pulley, and a supplemental running rope operated from the cage and passing around said loose pulley to operate said device.

4. In an elevator, the combination with the cage, of a stop and start mechanism, a running operative rope connected therewith, stationarily mounted devices adapted to engage said rope, and a supplemental line for operating said stationarily mounted devices to engage the rope and shift the stop and start mechanism.

5. In an elevator, the combination with the cage, of a stop and start mechanism for the motor, a running rope connected with the said mechanism and adapted to be moved by an operative in the cage, a running line supplemental to the rope for shifting the stop and start mechanism independently thereof, and means for automatically operating the said supplemental line when the car has reached a predetermined point in the travel, substantially as set forth.

6. In an elevator, the combination with the cage, the suspensory, and the counterweight, of the stop and start mechanism for the motor, a rope for operating the said mechanism, and a rope supplemental to that aforesaid and connected to and traveling with the cage and the counterweight, and also connected to the stop and start mechanism for operating the same, substantially as set forth.

7. In an elevator, the combination with the cage, of a stop and start mechanism for the motor, a running rope for operating said mechanism to start the motor, a running rope supplemental to said rope for operating said mechanism to stop the motor, and means for locking the said supplemental running rope against movement relatively to the car except at predetermined points, substantially as set forth.

8. In an elevator, the combination with the cage and a track extending up the elevator well and having offset or cut-away portions corresponding to the landings, of a stop and start mechanism for the motor, a rope for operating said mechanism to stop the motor

and devices on the cage for operating said rope, said devices having means engaging the said track whereby they can be operated only when the said means are opposite one of the offset or cut-away portions of the said track, substantially as set forth.

9. In an elevator, the combination with the cage, a cam-track having offset or cut-away portions, a stop and start mechanism for the motor, and a rope for operating said mechanism of a supplemental rope for operating said mechanism to stop the motor, a wheel for said supplemental rope on the cage, and devices rigidly connected with said wheel and engaging the cam track, whereby said wheel cannot be rotated except when said devices reach said offset portions substantially as described.

10. In an elevator, the combination with the cage, a cam track having offset portions corresponding to the landings, and a stop and start mechanism for the motor, of a rope for operating said mechanism to stop the motor and a wheel on the cage for said rope, and a lever engaging said cam track, whereby it can be moved only when opposite the offset portions, substantially as set forth.

11. In an elevator, the combination with the cage and the stop and start mechanism for the motor, of the means on the cage for operating said mechanism to start the motor with different degrees of speed, and means on the cage for stopping said car at an exact predetermined point irrespective of the speed of the cage, substantially as set forth.

12. In an elevator, a series of movable corridor doors, a cage, an operating line, a supplemental line, attachments carried by said supplemental line for simultaneously locking said corridor doors, and means interposed between the two lines whereby the supplemental line moves a distance less than the travel of the operating line.

13. In an elevator, a cage, a counterweight, and a suspensory, in combination with a stop and start mechanism, a rope, connected therewith and having clips or attachments, and means carried by the counterweight and cage, respectively for engaging said clips or attachments on said rope, substantially as set forth.

14. In an elevator, a cage, stop and start mechanism for the motor, two movable pulleys connected with said stop and start mechanism, a running rope passing around said pulleys for moving them to operate the stop and start mechanism, and means supplemental to said running rope for moving said pulleys to a neutral position whereby the said mechanism is brought to a non-active position, and the movement of the car is stopped.

15. The combination with the cage, the operating rope and the stop and start mechanism, of a sounding device, an electric circuit including said sounding device and a contact movable by said operating rope for closing said circuit for causing the sounding device to operate during the movement of the cage, substantially as set forth.

16. The combination with the traveling cage, of an electric circuit, an electric sounding device in said circuit and means for closing said circuit during the travel of the cage, whereby the sounding device is continuously actuated while the cage is in motion.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 5th day of February, A. D. 1895.

CHARLES A. HARKNESS.

Witnesses:

ARTHUR W. CROSSLEY,

C. C. STECHER.

(No Model.) 7 Sheets—Sheet 1.

C. A. HARKNESS.

ELEVATOR.

No. 553,157. Patented Jan. 14, 1896.

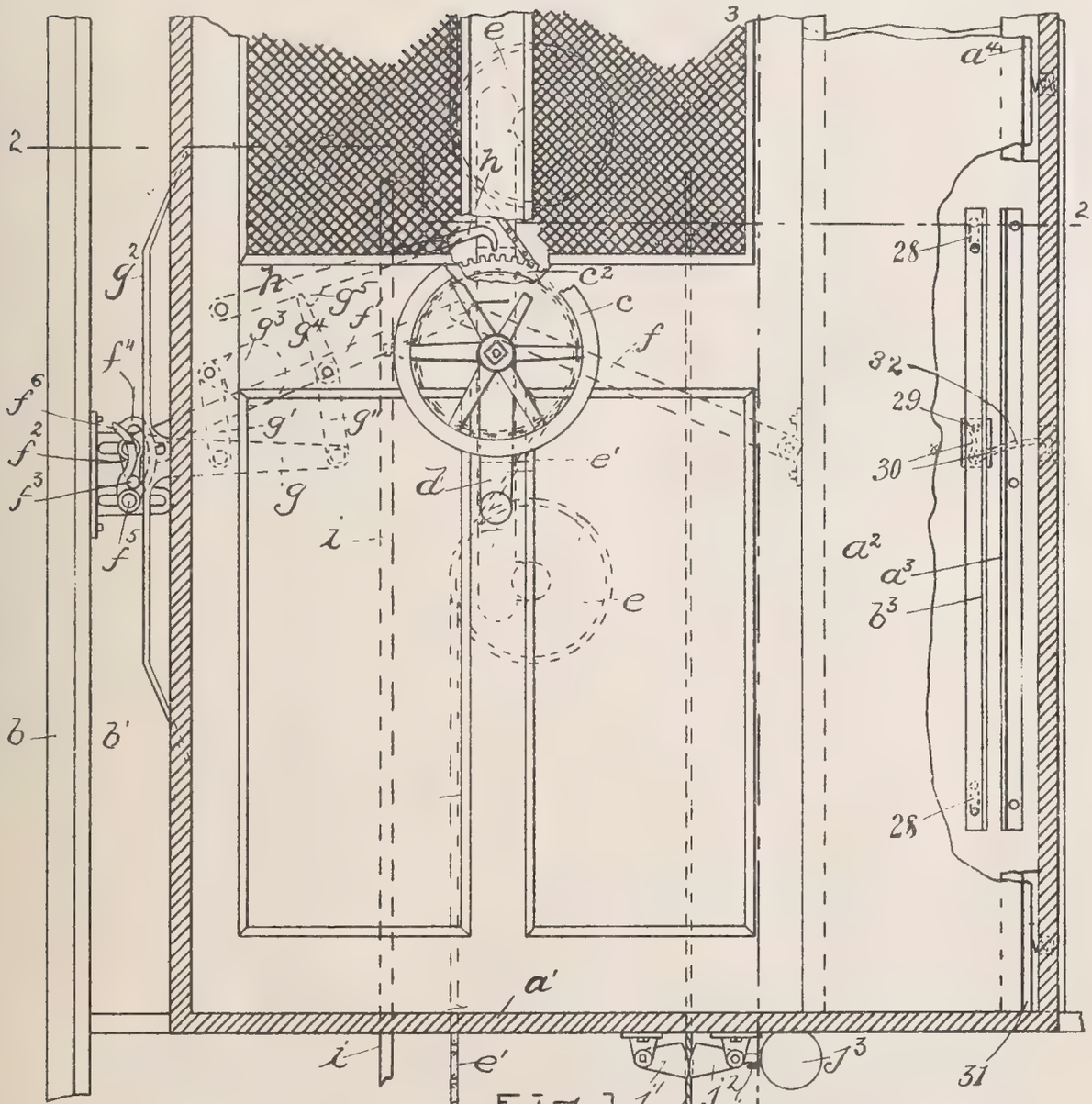

Fig. 1.

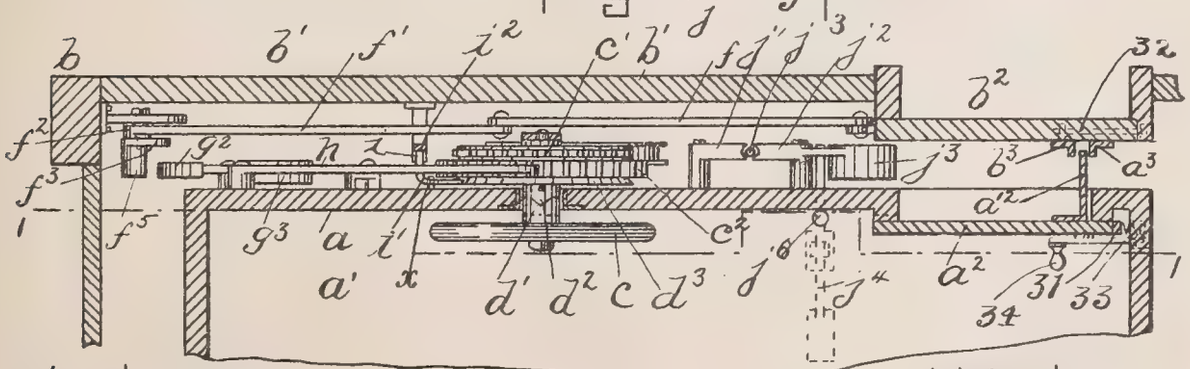

Fig. 2.

WITNESSES.
Matthew M. Blunt.
C. C. Stecher.

INVENTOR.
C. A. Harkness
by C. W. Goodwin
his ATT'Y.

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C. A. HARKNESS.

ELEVATOR.

No. 553,157. Patented Jan. 14, 1896.

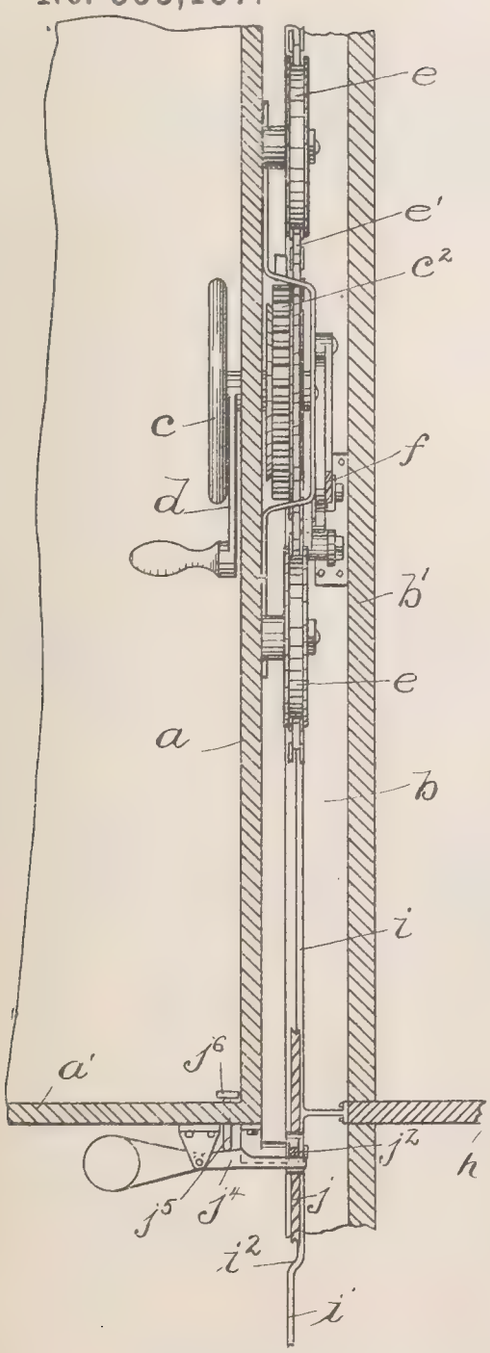

Fig. 3.

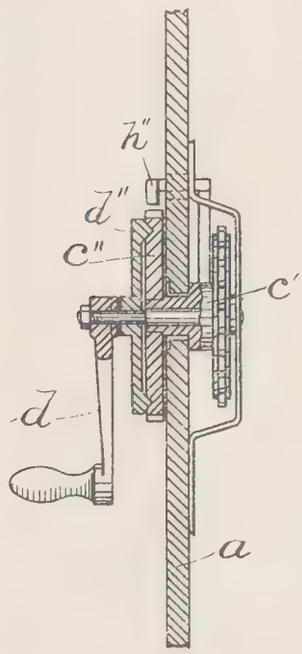

Fig. 4.

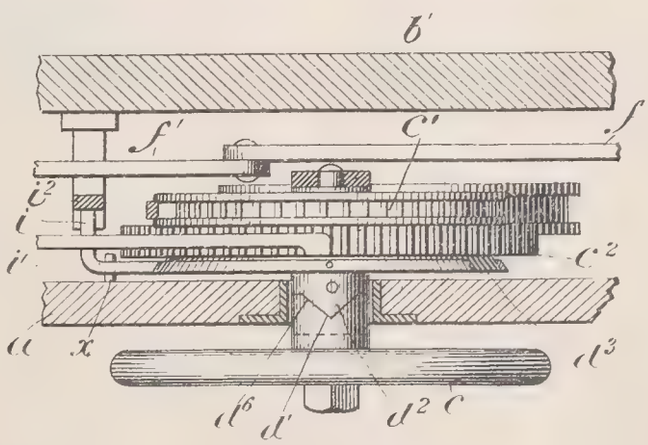

Fig. 4.a

WITNESSES.

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(No Model.) 7 Sheets—Sheet 3.

C. A. HARKNESS.

ELEVATOR.

No. 553,157. Patented Jan. 14, 1896.

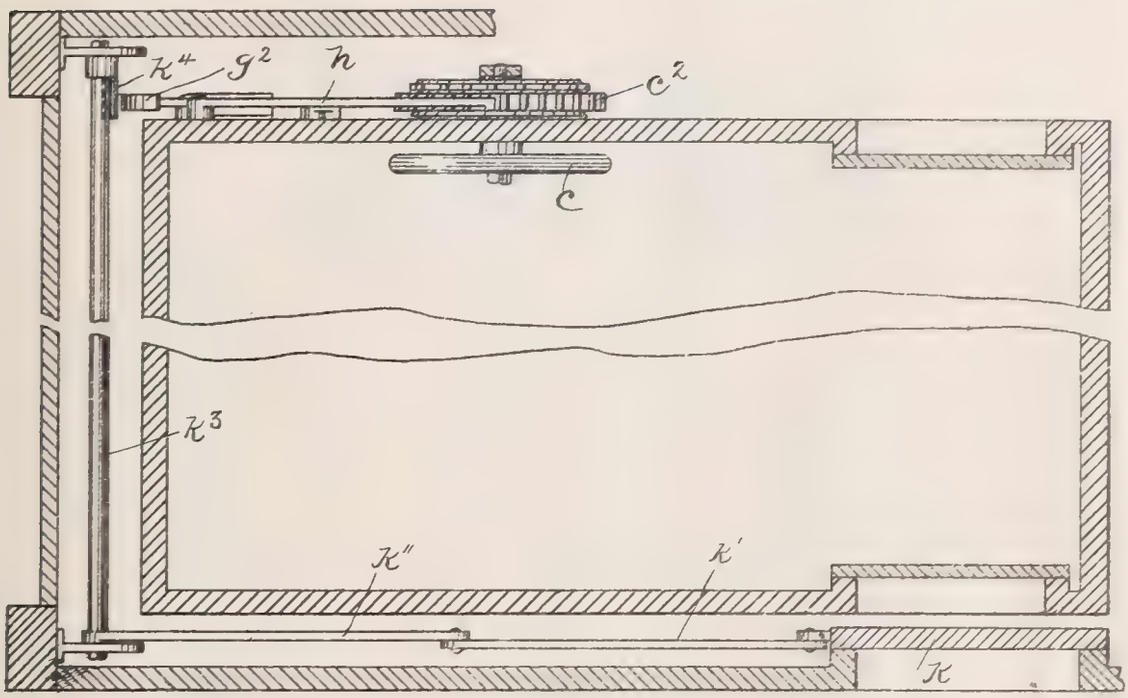

Fig. 5.

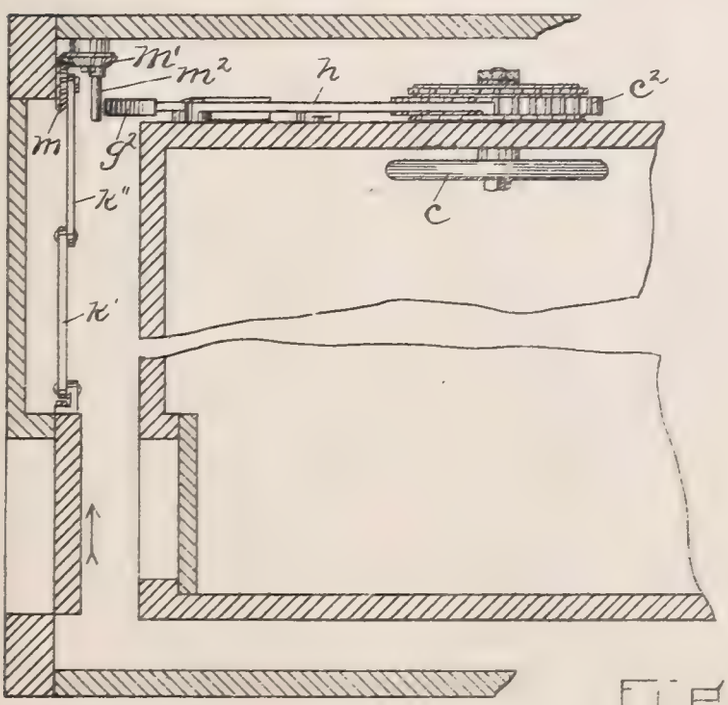

Fig. 6.

WITNESSES.
Matthew M. Blunt
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INVENTOR.
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by G. P. Sprague
his ATT'Y

(No Model.) 7 Sheets—Sheet 4.

C. A. HARKNESS.

ELEVATOR.

No. 553,157. Patented Jan. 14, 1896.

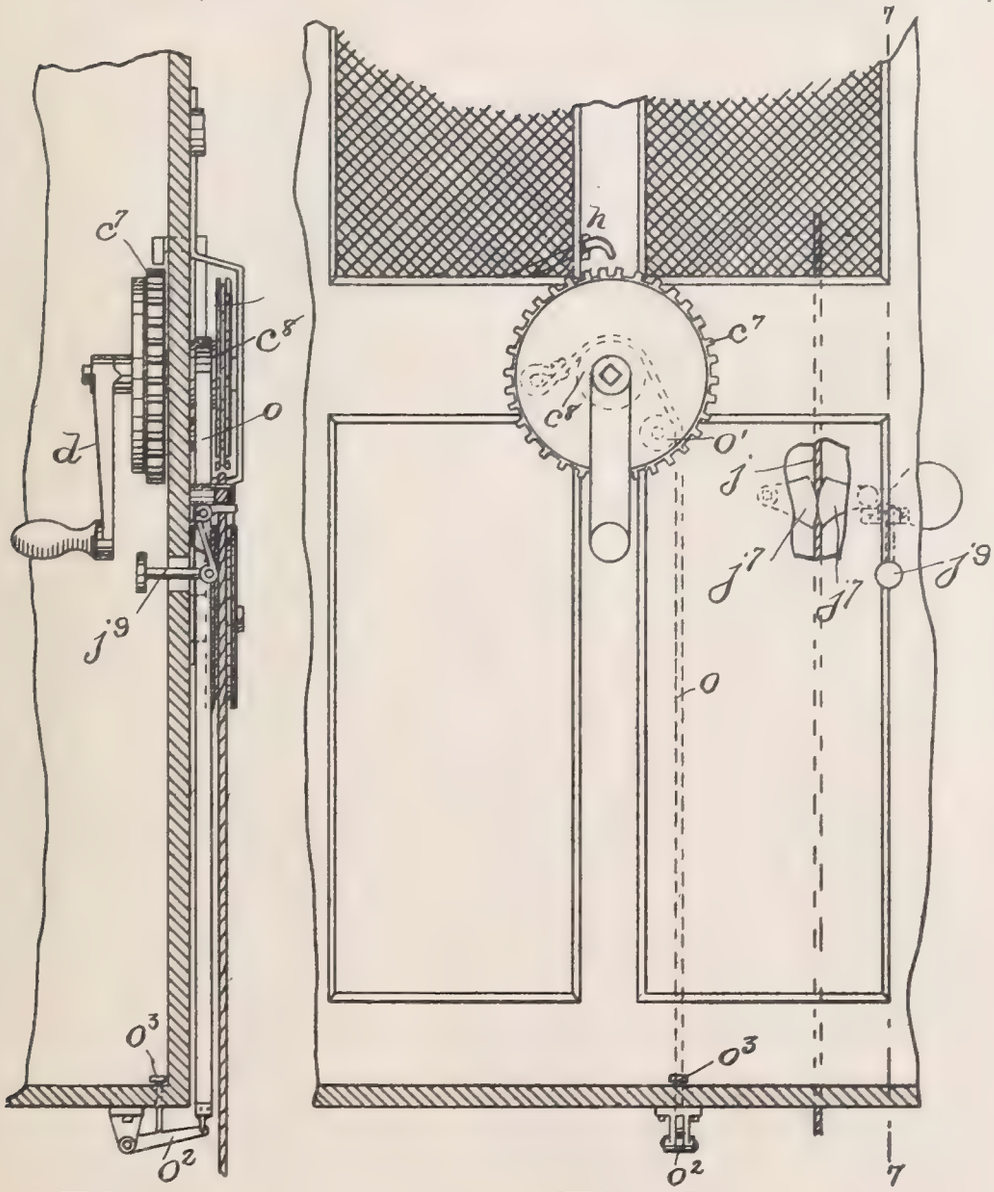

Fig 7. Fig. 8.

WITNESSES.
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(No Model.) 7 Sheets—Sheet 5.

C. A. HARKNESS.

ELEVATOR.

No. 553,157. Patented Jan. 14, 1896.

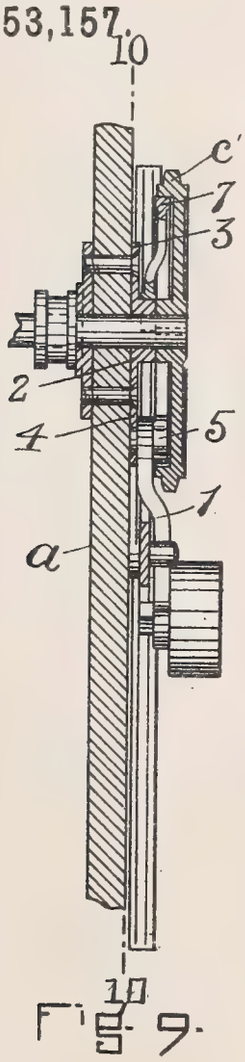

Fig. 9.

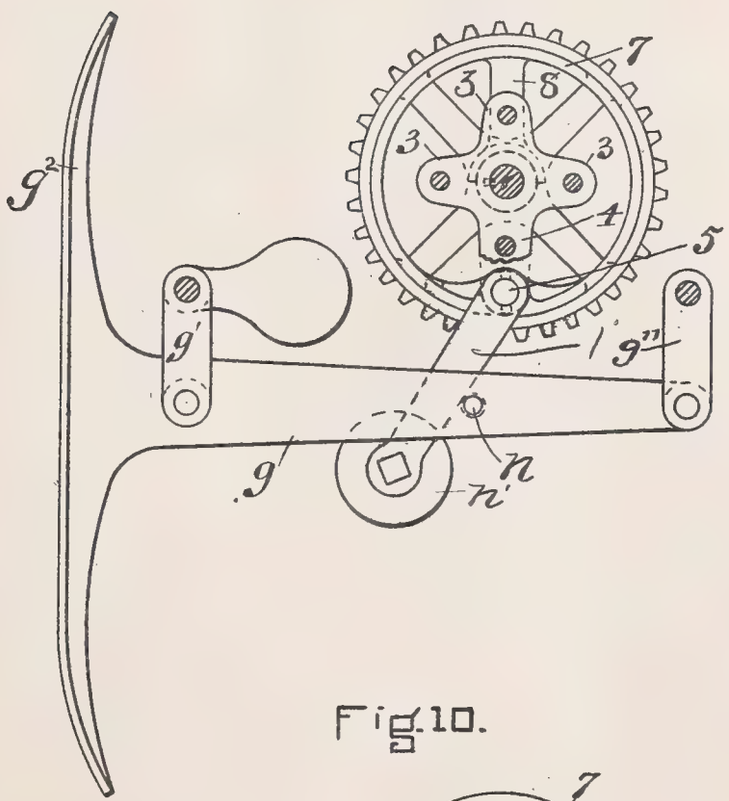

Fig. 10.

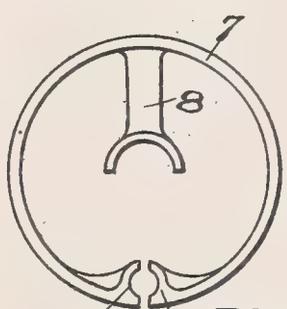

Fig. 11.

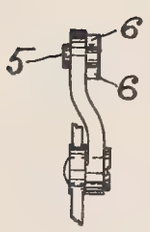

Fig. 12.

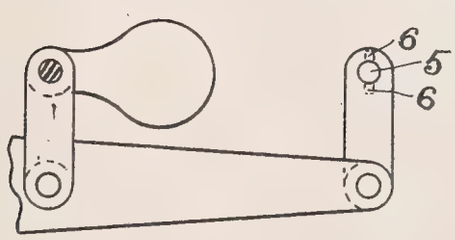

Fig. 13.

WITNESSES.
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Atty.

(No Model.) 7 Sheets—Sheet 6.

C. A. HARKNESS.

ELEVATOR.

No. 553,157. Patented Jan. 14, 1896.

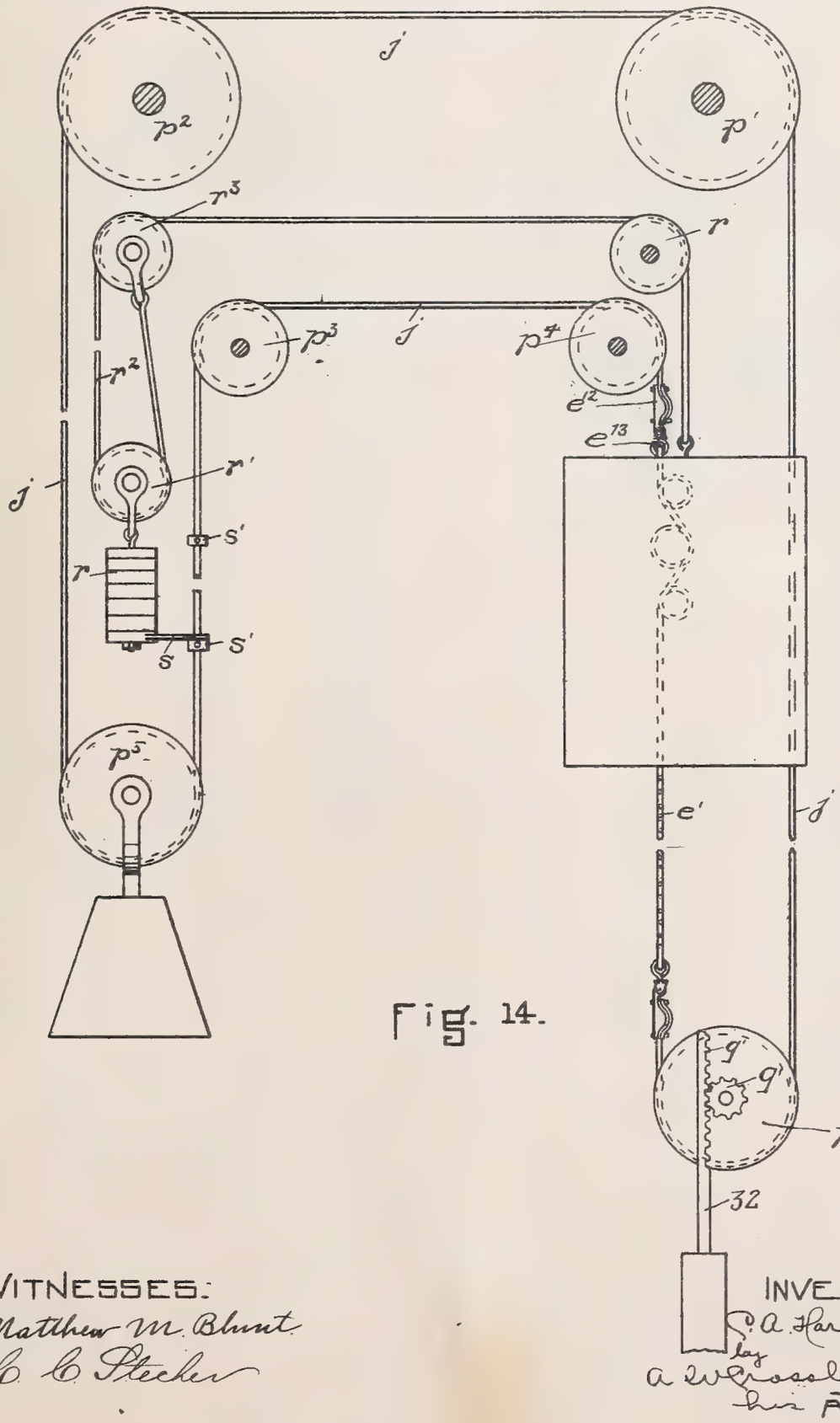

Fig. 14.

WITNESSES:
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(No Model.) 7 Sheets—Sheet 7.

C. A. HARKNESS.

ELEVATOR.

No. 553,157. Patented Jan. 14, 1896.

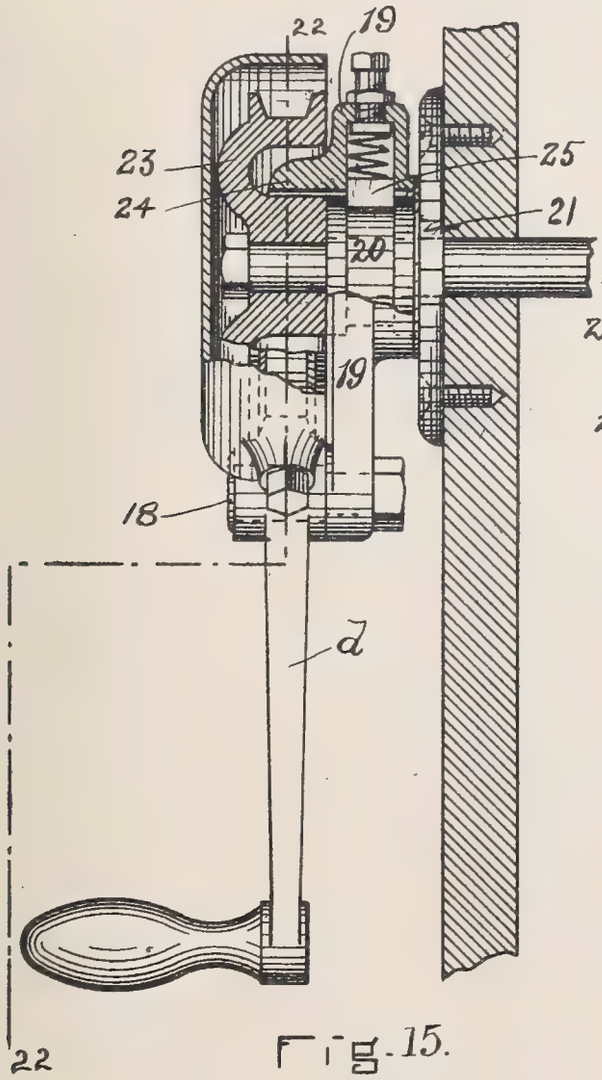

Fig. 15.

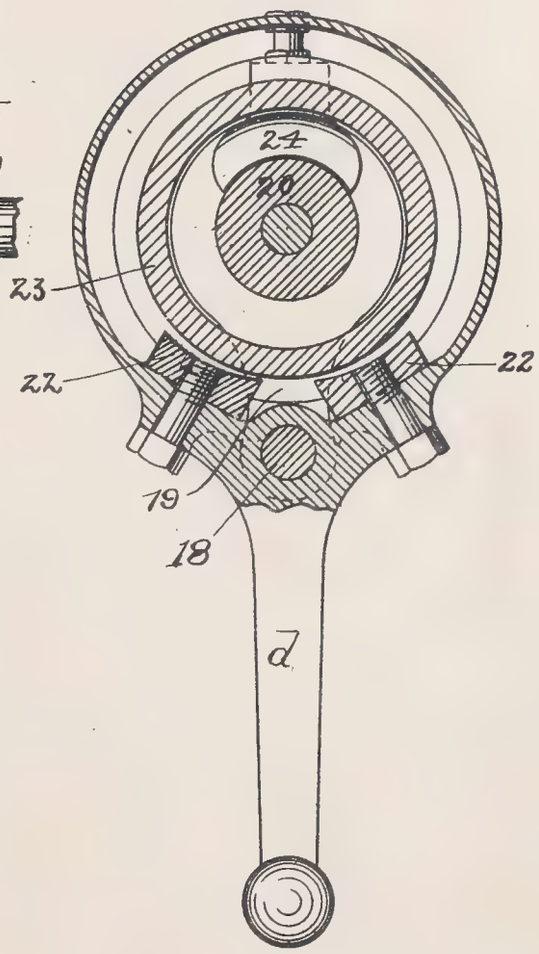

Fig. 16.

WITNESSES.
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C. C. Fletcher.

INVENTOR.
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by Dewey & Co.
his ATT'Y.

UNITED STATES PATENT OFFICE.

CHARLES A. HARKNESS, OF PROVIDENCE, RHODE ISLAND.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 553,157, dated January 14, 1896.

Application filed January 7, 1895. Serial No. 534,165. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. HARKNESS, of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Elevators, of which the following is a specification.

The present invention relates to means for controlling the operation of elevators, and the principal object is to establish such an interdependence between the motive power which moves the car and the means of access to the car that only under certain prescribed conditions can the car be started and stopped or access be had thereto.

Other objects are the provision of auxiliary means for accelerating the speed of the car, for effecting a gradual stoppage of the same, for obtaining a more direct connection between the devices in the car manipulated by the attendant and the valve of the motor, for opening and shutting both doors in unison, for directly connecting the line controlled from within the car with the main valve, and not through the medium of a pilot-valve, and for perfecting the construction and mode of operation of an elevator in various other parts.

In the accompanying drawings, which illustrate constructions embodying the invention, means are shown for accomplishing all of the above-recited objects.

Of the drawings, Figure 1 shows a sectional view of a sufficient portion of a car and hatchway or well to display the controlling devices, the car being represented as at a landing with the car-door and the door of the hatchway both closed and the former broken away, and also a portion of the side of the car broken out. Fig. 2 shows a section on the line 2 2 of Fig. 1. Fig. 3 shows a section on the line 3 3 of Fig. 1. Fig. 4 shows a sectional view of a modified form of means for manipulation by the attendant. Fig. 4^a is an enlarged view of parts shown in Fig. 2. Fig. 5 shows a horizontal section of the car and hatchway, illustrating a modified form of connection between the hatchway-door and the motor-controlling devices. Fig. 6 shows a similar view of another modification. Fig. 7 shows a view similar to Fig. 3, illustrating means for graduating the stoppage of the car. Fig. 8 shows an interior elevation of the same. Fig. 9 shows a sectional view similar to Figs. 3 and 7, illustrating a modification in the locking arrangement. Fig. 10 shows a section on line 10 10 of Fig. 9. Fig. 11 shows a detail of one member of the modified locking arrangement. Figs. 12 and 13 show further details of this modified locking arrangement, one being an edge view and the other a side view. Fig. 14 shows a diagrammatical view of a complete system. Figs. 15 and 16 show modified forms of clutching means hereinafter particularly described.

Referring first to Figs. 1, 2 and 3, the letter a designates one side of the car; a', the floor of the car; a^2, the sliding door of the car; b, a corner-post of the hatchway; b', the front of the hatchway, and b^2 the door thereof. The doors a^2 and b^2 are operatively connected by interlocking ribs a^3 and b^3, so that the opening of the door a^2 opens the door b^2.

Through the side a of the car there extends a shaft or spindle having affixed upon it inside the car a balance-wheel c, and outside the car a sprocket-wheel c' and a toothed detent-wheel c^2. A handle d is loosely mounted on said shaft within the car, the boss of said handle being formed with a V-shaped notch d' for engagement with a similarly shaped projection d^2 on the hub of a clutch-cone d^3, entering a socket formed for it in the wheel c^2. It will be seen that by turning the handle in either direction the coaction of the inclined surfaces of the notch d' and projection d^2 will cause the clutch-cone to be moved against the wheel c^2, and continued movement of said handle will turn said wheel and with it the wheel c'. A feather (not shown) on the shaft on which the cone moves forward insures the cone moving outward instead of turning. After the car has been started the handle will remain in the position to which it has been moved, and the clutch-cone will release itself and return to its original position relatively to the handle—that is, with the projection d^2 lying in the notch d'.

On the outside of the car there are two idlers e, one above and the other below the sprocket-wheel c', and a sprocket-chain e' is held in engagement with said wheel by the idlers. Said sprocket-chain is connected with the valve of the motor and the car runs along it as along the ordinary cable. It follows that the turning of the sprocket-wheel through the means

within the car above described shifts the valve.

The engagement of the controlling line or chain e' with the hand operative means, which in this instance consists of the hand operative device or lever d and the wheel c', is such that if the latter be locked against movement the line will be locked to the car to prevent creeping, as will be hereinafter explained. The wheel c' may be also considered as a line operative means and be rotated in any suitable way, although I generally employ the devices hereinafter described.

The sprocket-wheel is locked when the car is at a landing and the doors are open through the following-described devices: A toggle composed of two members f and f' connects the door b^2 with the post b, the member f' of said toggle having a lateral arm f^2 with a pin f^3 at its free end in engagement with a curved slotted arm f^4 pivoted at f^5 to a bearing in the post b.

There is a bar g suspended on the outside of the car by equal-lengthed links g' and g'', and said bar has an elongated cross-head g^2 presenting a face for the lug f^6 to act against when the car is at a landing. A weighted arm g^3 on the journal of the link g' tends to project the bar outward toward the said lug. The other link g'' is extended, as at g^4, for engagement with the under edge of a long gravity-pawl h, which overhangs the wheel c^2 and is formed with a stop-lug g^5 for said link to encounter. When the hatchway-door is closed, the link is against the lug and the pawl is held up out of engagement with the wheel, as shown in Fig. 1. The movement of the toggle consequent upon the opening of the door causes the lug f^6 to be thrown against the cross-head g^2 by the coaction of the pin f^3 and the slotted arm f^4, and bar g is swung inward, displacing the link g'' and allowing the pawl h to drop into engagement with the wheel c^2 and lock the latter so long as the door is open. Therefore the car cannot move away until the door is closed.

From the foregoing it will be apparent that I have provided locking devices under the control of the door for positively locking and releasing the line-operating means, so that when the movable door is opened the car is prevented from creeping.

To prevent stopping the car, except at landings, a vertical strip i is fastened along the inside of the hatchway, and the clutch-cone d^3 is equipped with an arm i' bent outward to bear against said strip. At the landings said strip has offsets i^2, which permit movement of the clutch-cone, whereas at all other places the strip constitutes a stop to movement of said clutch-cone, and consequently to shifting of the motor-valve.

Auxiliary means for accelerating the speed of the car by a fuller movement of the valve than producible by manipulation of the handle d are provided as follows: The return-rope j, which is continuous with the chain e', extends along the outside of the car and between cam-shaped grippers j' rigidly and immovably mounted on hangers and j^2 pivoted to hangers on the under side of the car-floor a', said gripper j^2 being weighted on the outer side of its pivot, as shown at j^3, so as to have a tendency to grip the rope between it and the other gripper. A lever j^4, pivoted under the car and having a weight superior to the weight j^3, extends under the weighted arm of the gripper j^2, and normally holds the same free of the rope, and the said lever j^4 has resting upon it the lower end of a pin j^5, projecting through the floor of the car and formed with a foot-pressure knob j^6 on its upper end. By pressing with his foot on the said knob the attendant causes the grippers to grip the rope, and the latter to be then taken along with the car so that the valve is more fully opened and the speed of the car accelerated.

In the modification shown in Fig. 4, the detent-wheel c'' and clutch-disk d'' (slightly different in shape from that in Fig. 1) are inside the car, and no balance-wheel is used. In some instances the balance-wheel may be used in this connection, and it may in some instances be dispensed with in the construction shown in Figs. 1 and 2. The locking-pawl h'' is bent at right angles and passed through the side of the car for engagement with the detent-wheel.

In some instances the doors of the hatchway will be differently located at different landings. Where the hatchway-door at a landing is at the opposite side to that of the ground-floor, I employ the arrangement shown in Fig. 5. The letter k designates the door at the landing and k' and k'' members of a toggle connecting said door with a rock-shaft k^3, which extends across the side of the car and carries a pendent crank k^4, to act against the cross-head of the swinging bar. Where the door occurs in a side of the hatchway at right angles to the side of the elevator-supporting devices, I employ the arrangement shown in Fig. 6. Here the hatchway or corridor door is connected with toggle-levers k' k'', like those before described, and said levers are likewise connected with the journal-stud of a bevel-gear m, which meshes with another bevel-gear m' provided eccentrically with an inwardly-projecting pin m^2, which is so constructed and arranged as to be caused to act against the cross-head of the swinging bar when the gear m' is turned, as it will be, by the sliding of the hatchway or corridor door through the medium of the toggle-levers.

Any other suitable equivalent connections between the door and means for controlling the pawl may be employed instead of those shown.

The purpose of locking the sprocket-wheel is for locking the operating-rope to the cars and thereby preventing the starting of the motor which is employed for raising or lowering the car, for by thus locking the rope to the car any movement of the motor caus-

ing the car to creep in one direction or the other will be immediately stopped or reversed by the pull of the car upon the line. Hence, this being one of the essential features of my invention, many changes may be made in the form in which it is embodied without departing from the spirit and scope thereof.

In Figs. 9 to 13, inclusive, the swinging bar g has a pin n against which a weighted gravity-lever 1 rests.

2 designates a plate secured to the side of the car and having three arms 3 3 3, by which it is fastened in place, and a longer arm 4, (part of which is shown in Fig. 10 by dotted lines as broken off,) through which the pivot or journal stud 5 connected with the gravity-lever 1 extends and in which it has a bearing. From the opposite end of the journal stud or pivot 5 there project radially in opposite directions pins or ribs 6.

7 designates a split clamping-ring arranged to fit within a circular chamber or recess formed in the side of the sprocket-wheel c', it being understood that, in this case, the detent and wheel with which it co-operates are dispensed with. Depending from the upper part of the split clamping-ring 7 is a saddle-arm 8, having a rounded bearing formed on its lower end, so as to be suitably supported on a fixed rounded bearing on the car. The confronting ends of the split ring at its divided point are provided with recesses 9 9, rounded or formed on the arc of a circle, and between the said split ends and within the said recesses the portion of the stud 5 bearing the ribs or pins 6 projects. The said ends of the split ring do not quite meet and when the lever 1 is in normal position the ribs 6 project into the space between the said ends.

It being understood that the split clamping-ring is normally loose with respect to the sprocket-wheel, when the swinging bar g is moved inward, the weighted lever n' drops, the stud 5 will be turned, and its ribs or pins 6 acting on the ends 9 9 will expand the split ring in the chambered side of the sprocket-wheel and lock it against turning. The lever 1 and its journal-stud 5 are, of course, supported and maintained in position by the plate 2.

It will be understood that the weight on the lever 1 is inferior to that which impels the swinging bar outward, so that the parts will normally be held so that the split ring will be in unlocked or unclutched position with respect to the ratchet-wheel.

In Figs. 15 and 16 there is shown an alternative form of means for clamping the handle or lever to its shaft in order to move the latter and control the valve. In these last-mentioned figures the handle or lever d is pivoted at 18 upon the lower end of a bracket 19 arranged upon the hub 20, which hub forms part of, or is connected with, the plate 21 affixed to the car. Connected with the handle at its base and on opposite sides of its pivotal point are two friction-shoes 22 22, one or the other of which is adapted to bear upon the wheel 23 in a groove formed on its periphery, which wheel is affixed to the sprocket-shaft. The bracket 19 at the point opposite to that at which the lever-handle is pivoted thereto is provided with a projection 24, which extends into grooves formed in the wheel 23.

It will be seen that when the handle d is moved from the right to the left around the pivot 18 the projection 24 and one of the shoes 22 will grip or clamp the wheel 23, and then turn the shaft.

In the upper part of the bracket 19 there is a spring-pressed friction-shoe 25, which bears on the hub 20 with sufficient force to insure the swinging of the handle on the pivot 18 of the bracket when a movement is made to clutch the adjuncts of the handle with the shaft in either direction. The friction between the last-mentioned shoe and the hub 20 is not sufficient, however, to prevent the sliding of the same thereon after the handle and its adjuncts shall have been clamped to the shaft.

There is a screw shown above the spring of the spring-pressed shoe for adjusting the tension of the spring in order to regulate the frictional contact of said shoe with the hub.

In Figs. 1 and 2 there are shown contrivances whereby the door a^2 of the elevator car or lift may be connected with the corridor or hatchway door b^2, so that the two may be opened and closed in unison, and so that by moving the door a^2 to open it the door b^2 may first be unlatched and then also opened.

a^3 is a stationary strip attached in vertical position to the corridor-door b^2, and b^3 is a strip arranged when in normal position substantially parallel to the strip a^3, the strip b^3 being connected to the corridor-door by means of links 28 (shown in dotted lines) pivoted at one of their ends to the door and at the other end to said strip. At a proper point the strip b^3 is provided with an outwardly-projecting arm 29 adapted when the strip b^3 is moved laterally to act against the latch-handle 30 (see dotted lines in Fig. 1) and move the latch 32 to unlatch the door. The gravity of the said strip b^3 is sufficient to move it to normal position, as is shown in said Fig. 1.

The door a^2 is provided with a latch 33 with a handle 34, and is adapted to be closed against a spring-pressed strip, (see Fig. 2,) so that in closing the door a^2 it may be latched and moved still farther to fully close and latch the door b^2. The springs bearing against the strip 31 are limited in their outward movement, so that after the door a^2 is moved to latch the door b^2 the said springs will operate to move the door a^2 back to a predetermined position, which backward movement will bring the strip a^{12}, connected with the door a and extending between the strips a^3 and b^3, to a point intermediate of said strips and so that it will not bear against either in the movement of the car up and down. Thus

it will be seen that the two doors are provided with connections (strip a^{12}, strips a^3 and b^3, &c.) between them, whereby the opening and closing of the car-door a^2 will unlatch and open or close and latch the corridor-door.

Referring now to Fig. 14, it will be noted that the sprocket-chain e' is connected at its ends to the rope j so as to form with the said rope an endless line, running directly from the valve-wheel p to and about sheaves or pulleys p' p^2, the sheave p^5 of the tension device and sheaves p^3 p^4, back again to the valve-wheel. The tension device is provided with a weight and is movable vertically with the sheave p^5 in order to keep the line formed by the rope j and chain e taut at all times. The ends of the rope are connected with the ends of the sprocket-chain through intermediate devices, each consisting of a clamp e^{12} clamped firmly upon a bight of the rope laid over a hump therein, and an eye e^{13} swiveled in the end of the clamp, so that any twisting of the rope may not affect the position of the chain on the sprocket-wheel.

It is to be particularly noted that by my means, as represented in Fig. 14, the controlling means in the car connect directly with the main valve 32 of the motor through the medium of a main-valve-operating means, such as the valve-wheel p, and does not operate through the medium of a pilot-valve or other similar means, as is generally the case in elevators. The means herein shown for this direct connection with the main valve consist of a spur-gear q on the valve-wheel or sheave p, which meshes with a rack q' formed on the stem of the main valve.

The controlling-line is passed around the valve-wheel in such way that the latter may be positively rotated in either direction by the line, instead of positively rotating it in one direction by means of the line and relying upon a weight or equivalent devices to rotate it in the opposite direction. Nor do I limit myself to a valve-wheel, as any other of the devices now employed for operating the valve may be used instead. This direct connection with the main valve is an important feature of my invention, since it enables me to obtain a certain and an immediate responsive action of the valve to any movement of the handle or lever to operate the same.

It has heretofore been practically impossible to employ a relatively stationary line or standing rope connected directly with the main valve, in combination with a lever mounted at or near the floor of the car, owing to the fact that a considerable length of play of the main valve is required, which cannot be accomplished by means of a lever. It is necessary to move the line at least from a foot to six feet to shift the valve, and where a lever is employed in combination with a wheel concentric with the pivot or fulcrum thereof it is impossible to revolve the wheel for more than one-fourth of its revolution. Hence the line which passes over the wheel is moved but a few inches when the lever is moved from one limit to its other limit. Therefore it is necessary to employ some device by means of which the wheel may be revolved so that the standing rope or line may be moved a number of feet relatively to the car, and I have found that it can be done by means of a handle or hand-wheel adapted to be connected with the rope or line wheel, the hand-wheel or handle being capable of being rotated any desired number of times. Thus by connecting the standing rope or line with the valve-rod by means of the drum-pinion and rack passing around a wheel on the car and connecting a handle or hand-wheel with the rope-wheel or the axle thereof I can rotate the rope-wheel as many times as may be desired to move the line and therefore the valve to the proper extent.

The counterpoise or counterbalancing weight r for the car or lift is suspended from a sheave r' under which passes a rope r^2 connected at its nearest end to a suitable stationary object, the said rope passing from the sheave r', over other sheaves r^3, and is connected at its other end to the top of the car or lift.

The counterbalancing-weight carries an arm s, which extends between tappets s' on the rope j, so that when the car reaches the limit of its movement in either direction the motor-valve will be shifted so as to stop the car's movement in that direction.

When a car is run at high speed I provide means for graduating its stoppage, as shown in Figs. 7 and 8. The sprocket-wheel c^7 is formed with a hub c^3, and a strap o, fastened at one end to the car, passes over said hub and over a small idler o' on the car, and thence depends for connection with a lever o^2, pivoted under the car-floor. Said lever has an upstanding arm o^3, which projects through the floor of the car and has a knob for the application of the attendant's foot. By pressure on this knob the attendant puts a brake on the wheel c^7 and it is gradually stopped in its rotation, which effects the closing of the motor-valve. This is of great advantage, as the car is thus stopped when the handle is disengaged from the wheel. When the car is traveling rapidly and the wheel is turning, the handle hangs normally motionless, and it is easier to stop the rotation of the wheel by means of the brake than it would be to clutch the handle thereto. When this brake mechanism is used under control of the attendant's foot, the speed-accelerating devices are somewhat modified, the grippers j^7 being applied by operating a pull or push rod j^9 which connects with a bell-crank lever extending under the weighted gripper.

It will be understood that the line j may be composed as described or that a rod may be employed instead, running directly to the immediate means for controlling the main valve.

It is evident the invention is capable of embodiment in numerous ways, and hence I wish

it understood that I do not limit myself to the forms of mechanism here shown.

I do not herein broadly claim a car-controlling device for elevators comprising a flexible line for controlling the motor, and a hand device on the car for operating the same, combined with a movable door and a device normally disconnected from the controlling-line, and coacting with said door for preventing the operation of said hand device when the door is moved toward open position and until it is closed, as that forms the subject-matter of a claim in my copending application, serially numbered 533,652, filed January 2, 1895.

I do not herein claim, broadly, an elevator-controlling apparatus comprising a controlling-line, a hand-operative device on the car connected therewith, a lock movably mounted on the car, lock-actuating mechanism, a door and means connected with said door to operate said lock-actuating mechanism so as to cause said hand-operative device to be locked when the door is partially or entirely open, as this is claimed in my copending application, Serial No. 566,051, filed October 18, 1895.

Having thus explained the nature of the invention and described a way of constructing and using the same, though without attempting to set forth all of the forms in which it may be made or all of the modes of its use, it is declared that what is claimed is—

1. In an elevator apparatus, the combination with a car adapted to travel up and down in the well or hatchway, a main valve operating means, a wheel on the car, and a hand operative device for freely revolving said wheel, of a line relatively to which the car travels and extending from the main valve operating means to and around a sheave in the well or hatchway, and from thence back to said main valve operating means, said line passing around the first said wheel on the car at points between the said sheave and said valve operating means, whereby when said hand operative device is revolved in either direction, the line and thereby the main valve operating means are positively shifted in one direction or the other.

2. In an elevator apparatus, the combination with the car of a line extending along the entire hatchway or well and connected with the main valve to operate the same, said car traveling relatively to the line, the part of said line extending throughout the travel of the car consisting of a sprocket chain, a sprocket-wheel engaging said section of chain, and means within the car to move said sprocket wheel and therefore the sprocket chain in one direction or the other.

3. In an elevator apparatus, the combination of the car and its sliding door, with the sliding door of the corridor or hatchway and its latch, and connections between the two doors to operate on the said latch, whereby the opening and closing of the car door will unlatch and open, and close and latch the corridor door.

4. Elevator controlling means comprising a valve shifting line, a wheel on the car for said line, a handle, a clutch between said wheel and said handle whereby said handle may be engaged and disengaged from said wheel, and a brake for said wheel, for engaging it to stop the car when the handle is disengaged therefrom.

5. Elevator controlling means, comprising a motor actuating line, line operating means on the car engaged with the line for shifting it in either direction, the engagement being such that if the line operating means be locked, the line will be locked to the car, and means for locking the said line operating means, whereby the line is locked to the car to prevent creeping of the same.

6. In an elevator apparatus, a car, and a tension device, in combination with an endless line running directly from the valve wheel over stationarily mounted pulleys at the top of the well or hatchway, thence down around said tension device, thence up over second stationarily mounted pulleys at the top of the well or hatchway and down to the said valve wheel, said line being provided at points between the tension device and said stationarily mounted pulleys with tappets, a counterbalancing weight provided with an arm to engage said tappets to stop the car at the limits of its movement and a rope connected to the car from which said counterbalancing weight is suspended.

7. Elevator controlling means comprising a valve shifting line, hand operative means on the car engaging the line to move it in either direction, the engagement being such that if the hand operative means be locked the line will be locked to the car, a movable door, and locking devices on the car controlled by said door for locking the hand operative means whereby the line is locked to the car as aforesaid.

8. Elevator controlling means comprising a valve shifting line, means on the car engaging the line for operating it, a door, and locking devices controlled by said door for positively locking and releasing the line operating means, whereby the line is locked to the car to prevent creeping of the same and unlocked therefrom, substantially as and for the purposes set forth.

9. Elevator controlling means comprising a valve shifting line, a wheel engaged therewith, a handle, means of connection between the latter and the wheel, a door, and locking means controlled thereby for positively locking and releasing the wheel.

10. Elevator controlling means comprising a valve shifting line extending along the outer side of the car, a wheel engaged with said line, a door, means controlled thereby for positively locking and releasing the said wheel, a handle on the interior of the car, and a clutch between the handle and the wheel.

11. Elevator controlling means comprising a valve shifting line extending along the outer

side of the car, a wheel engaged with said line, a detent-wheel fast with said wheel, a locking pawl for engagement with said detent-wheel, a door, means connected with the said door for engaging said pawl with and disengaging it from the detent-wheel, a handle inside the car, and means of connection between said handle and the detent-wheel.

12. Elevator controlling means comprising a valve-shifting line outside the car, a wheel on the car engaged with said line, a locking device to hold said wheel stationary, a swing-bar operatively connected with said locking device and having an elongated abutment-face, a door and means actuated by the opening of the said door for moving said bar to operate the lock.

13. Elevator controlling means comprising a valve-shifting line outside the car, a wheel on the car engaged with said line, a locking device to hold said wheel stationary, a swing-bar operatively connected with said locking device and having an elongated abutment-face, an arm pivoted to the hatchway and having a lug to act against said abutment-face, a door, and a toggle connecting said arm and said door.

14. Elevator controlling means comprising a valve-shifting line outside the car, a wheel engaged with said line, a detent-wheel fast with said wheel, a gravity-pawl for engagement with the detent-wheel, a swing-bar, having an elongated abutment face, links supporting said bar and one of them being extended for engagement with the gravity detent, an arm pivoted to the hatchway and having a lug to act against the abutment-face of said swing-bar, a door and means connecting said arm and the said door.

15. Elevator controlling means comprising a valve-shifting line outside the car, a wheel engaged therewith, a handle on the interior of the car, a clutch between the handle and the wheel, and means in the hatchway for preventing closing of the clutch except at landings.

16. Elevator controlling means comprising a valve-shifting line outside the car, a wheel engaged with said line, a handle inside the car, a clutch for connecting the handle and wheel, one of the clutch members and the handle having engaging surfaces for producing longitudinal movement of the clutch member by turning the handle, and the clutch member having a laterally projecting arm connected therewith; and a strip extending along the hatchway in front of said arm on the clutch to prevent movement of the latter, said strip being offset or interrupted at intervals for the purpose described.

17. In elevator controlling apparatus, a valve-shifting line outside the car, grippers on the car for engagement with said line, one of said grippers being weighted to produce a gripping action, and a superiorly weighted lever sustaining said weighted gripper and having an actuating piece projecting into the car.

18. The combination, with the car, and corridor doors of an elevator, of connections between the doors whereby they may be opened and closed in unison, yielding means connected with one of the doors, which will permit of it being closed and latched and moved still farther to close the other door, and then be moved back to a limited extent.

19. Elevator controlling means comprising a movable door, a car, a motor actuating line, and movable door actuated means on the car for locking the line thereto, whereby if the car creeps after the car is stopped and the door is opened, the motor will be actuated to counterbalance such creeping.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 20th day of November, A. D. 1894.

CHARLES A. HARKNESS.

Witnesses:
M. B. MAY,
C. C. STECHER.

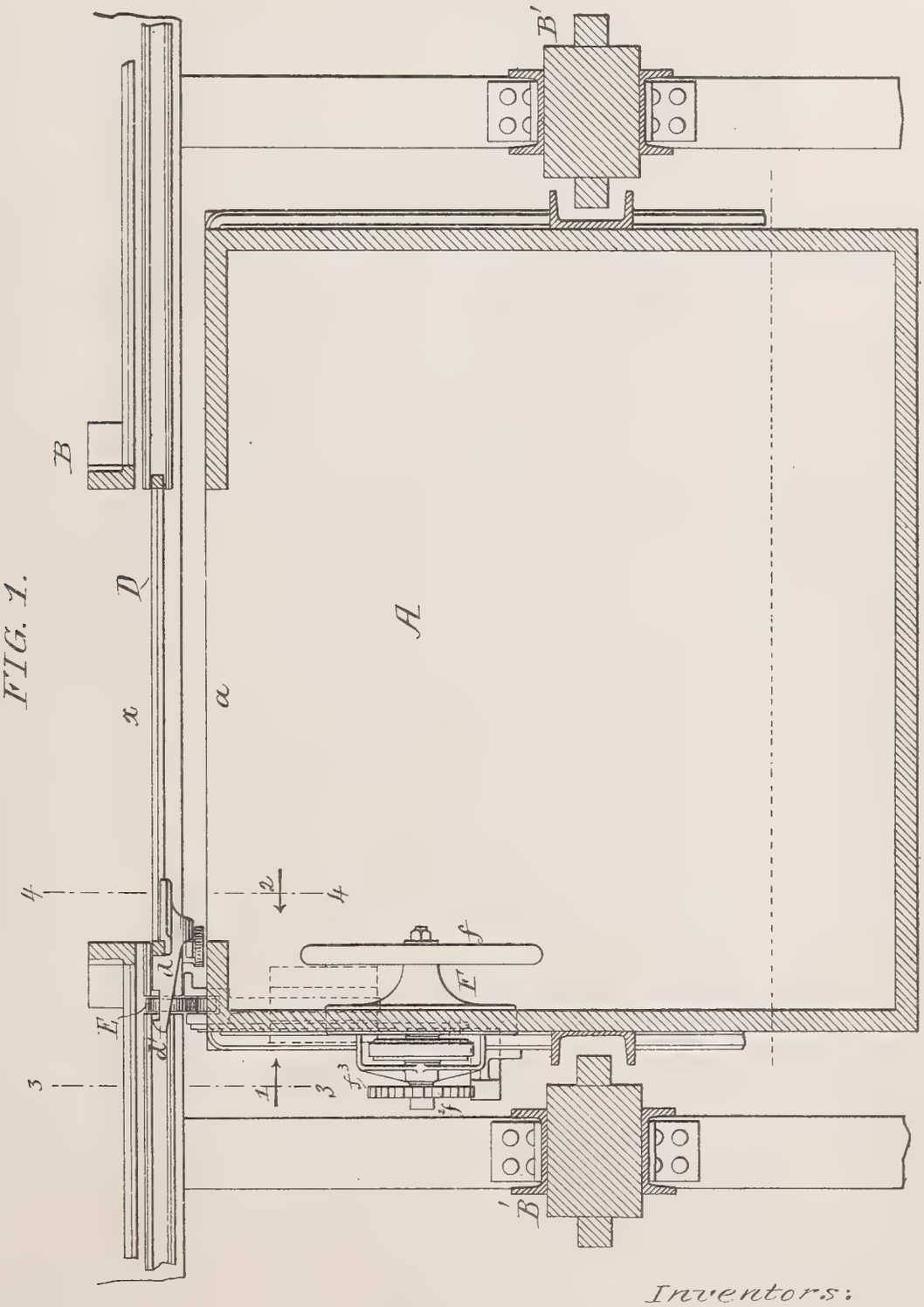
(No Model.) 4 Sheets—Sheet 1.

J. S. MUCKLÉ & W. H. B. TEAMER.

ELEVATOR.

No. 555,825. Patented Mar. 3, 1896.

FIG. 1.



Witnesses:
F. L. Benner
H. D. Goodwin

Inventors:
John S. Mucklé and
William H. B. Teamer
by their Attorneys
Howson & Howson

THE NORRIS PETERS CO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 2.

J. S. MUCKLÉ & W. H. B. TEAMER.

ELEVATOR.

No. 555,825. Patented Mar. 3, 1896.

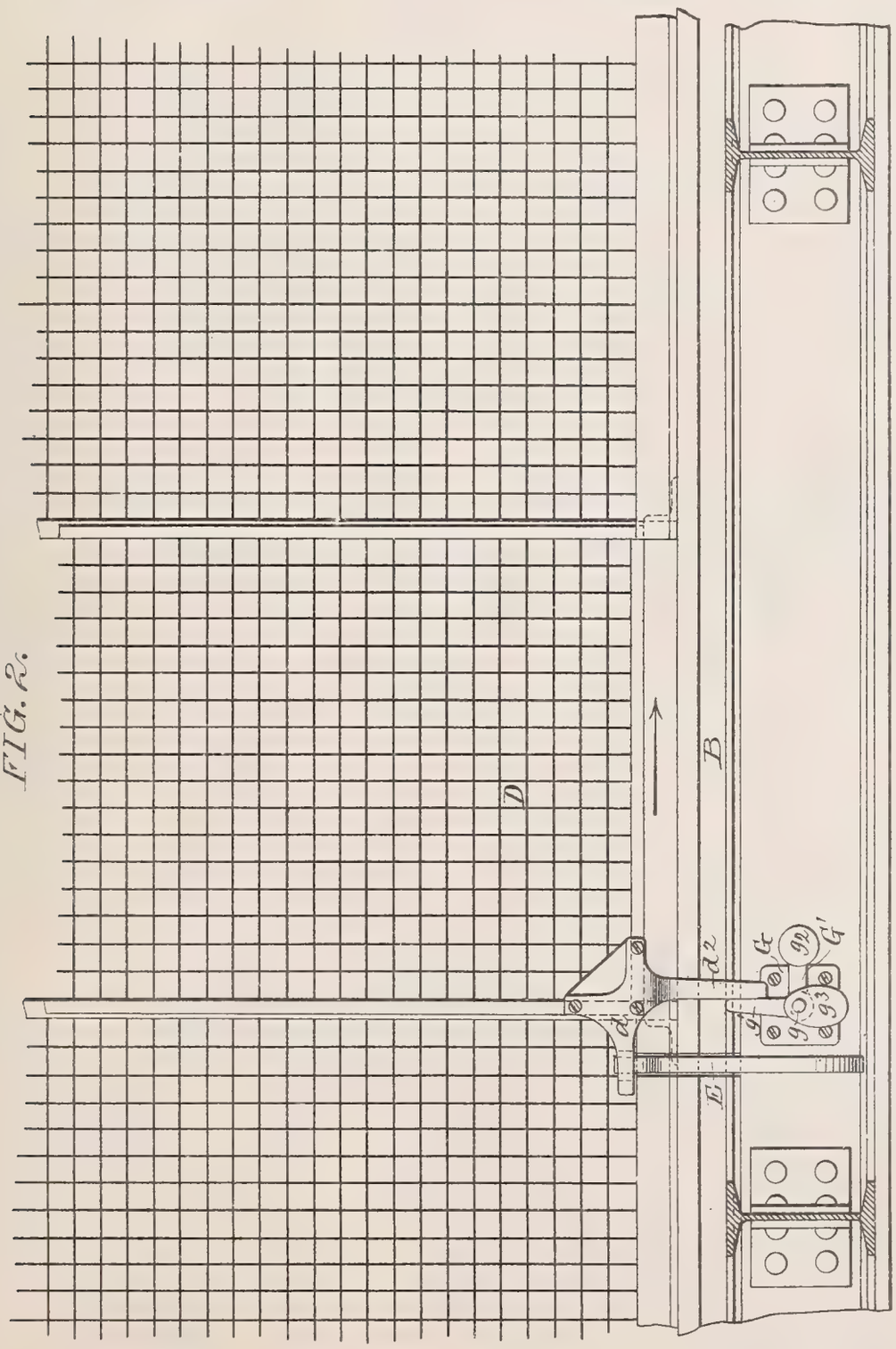


FIG. 2.

Witnesses:
F. D. Benner
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THE NORRIS PETERS CO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 3.

J. S. MUCKLÉ & W. H. B. TEAMER.

ELEVATOR.

No. 555,825. Patented Mar. 3, 1896.

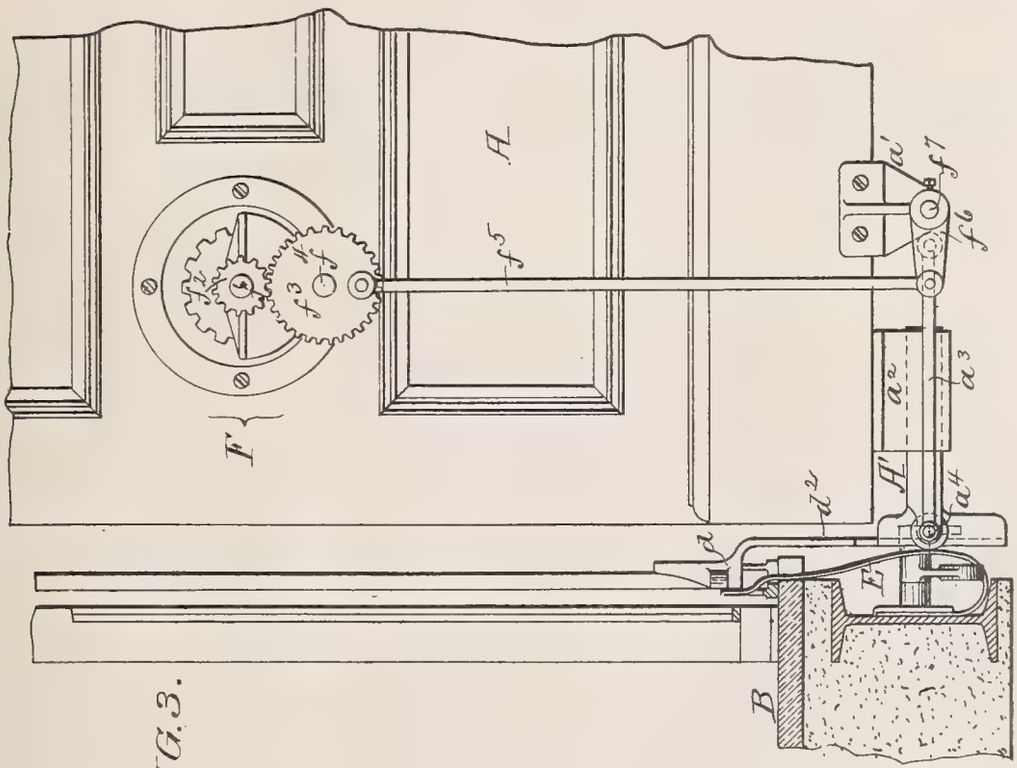


FIG. 3.

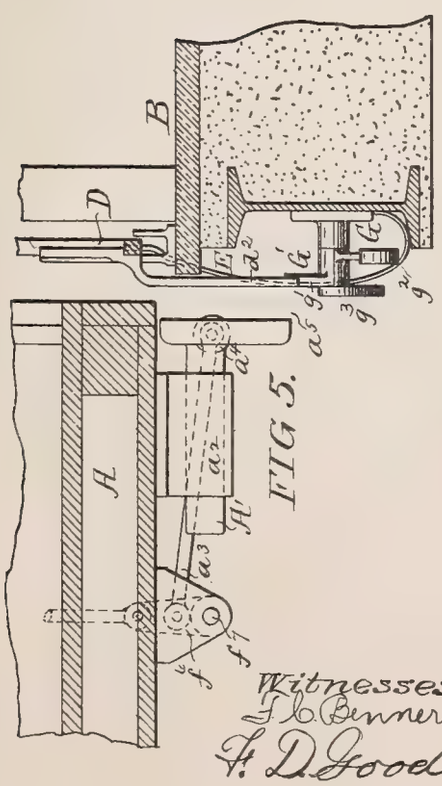
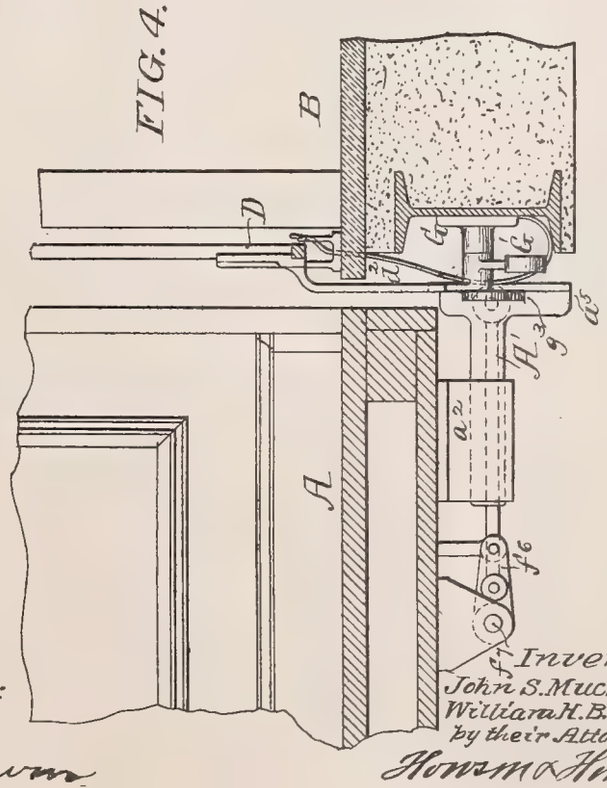


FIG 5.

FIG. 4.



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THE NORRIS PETERS CO., WASHINGTON, D. C

(No Model.) 4 Sheets—Sheet 4.

J. S. MUCKLÉ & W. H. B. TEAMER.

ELEVATOR.

No. 555,825. Patented Mar. 3, 1896.

FIG. 6.

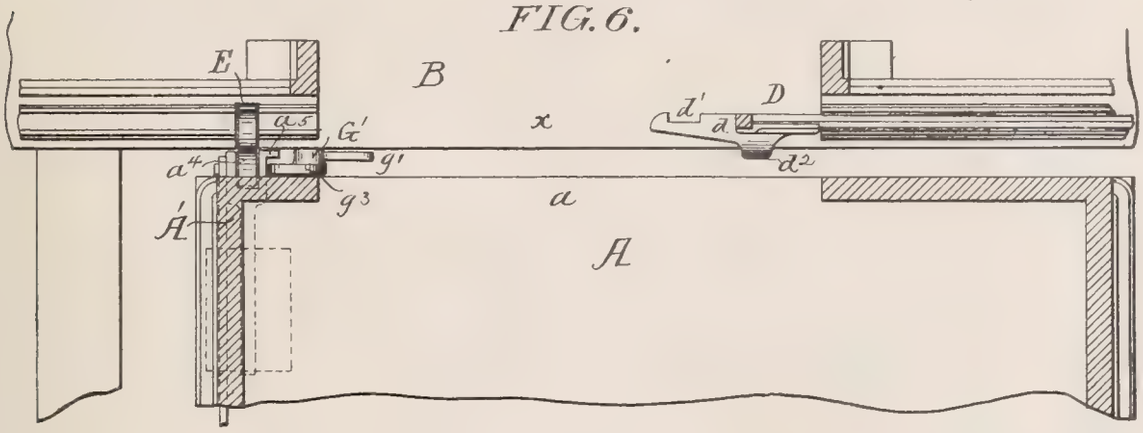


FIG. 7.

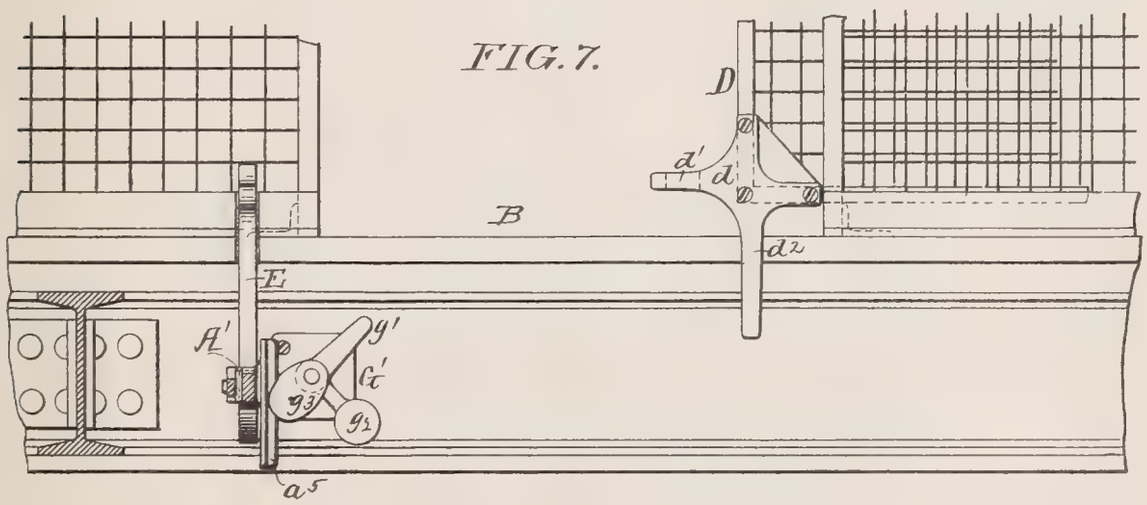
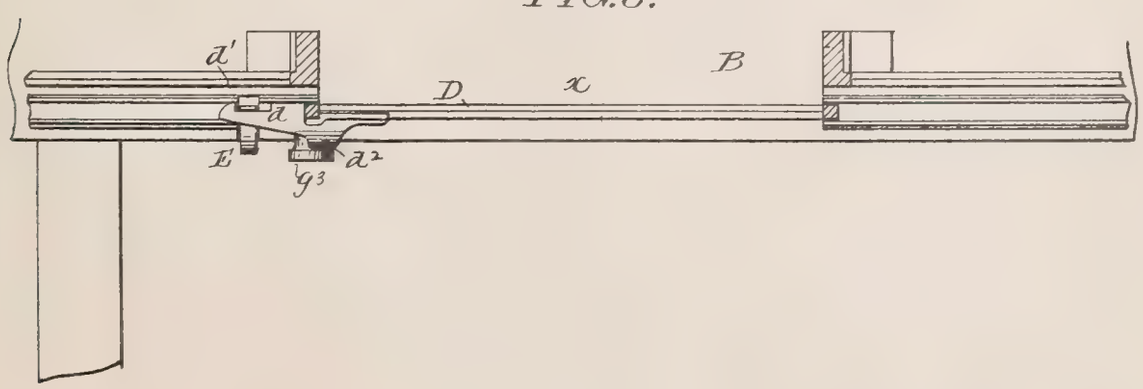


FIG. 8.



Witnesses:
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THE NORRIS PETERS CO., WASHINGTON, D. C.

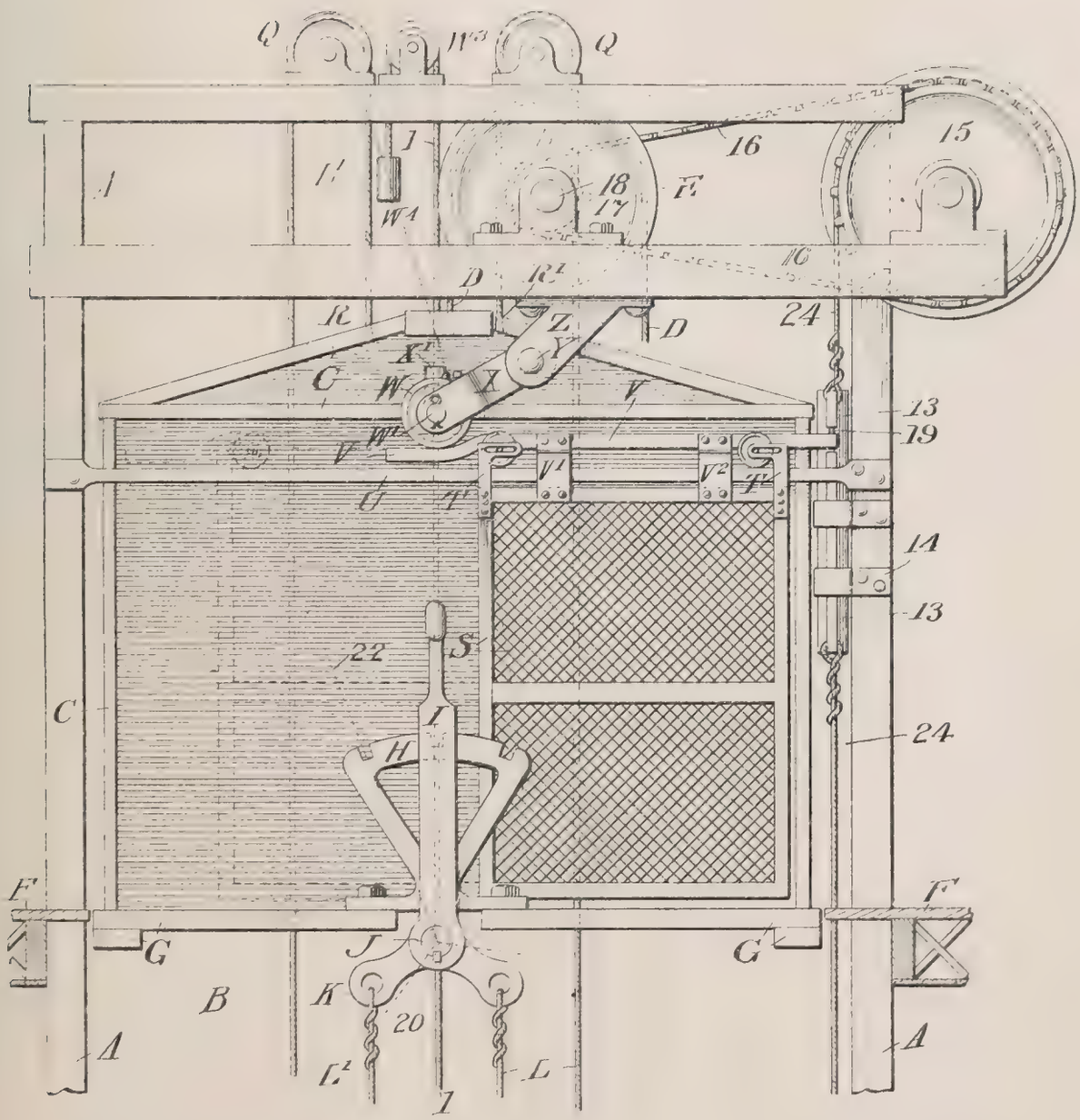
(No Model.) 3 Sheets—Sheet 1.

A. C. HUNT.

LOCKING MECHANISM FOR ELEVATORS.

No. 564,884. Patented July 28, 1896.

Fig. 1.



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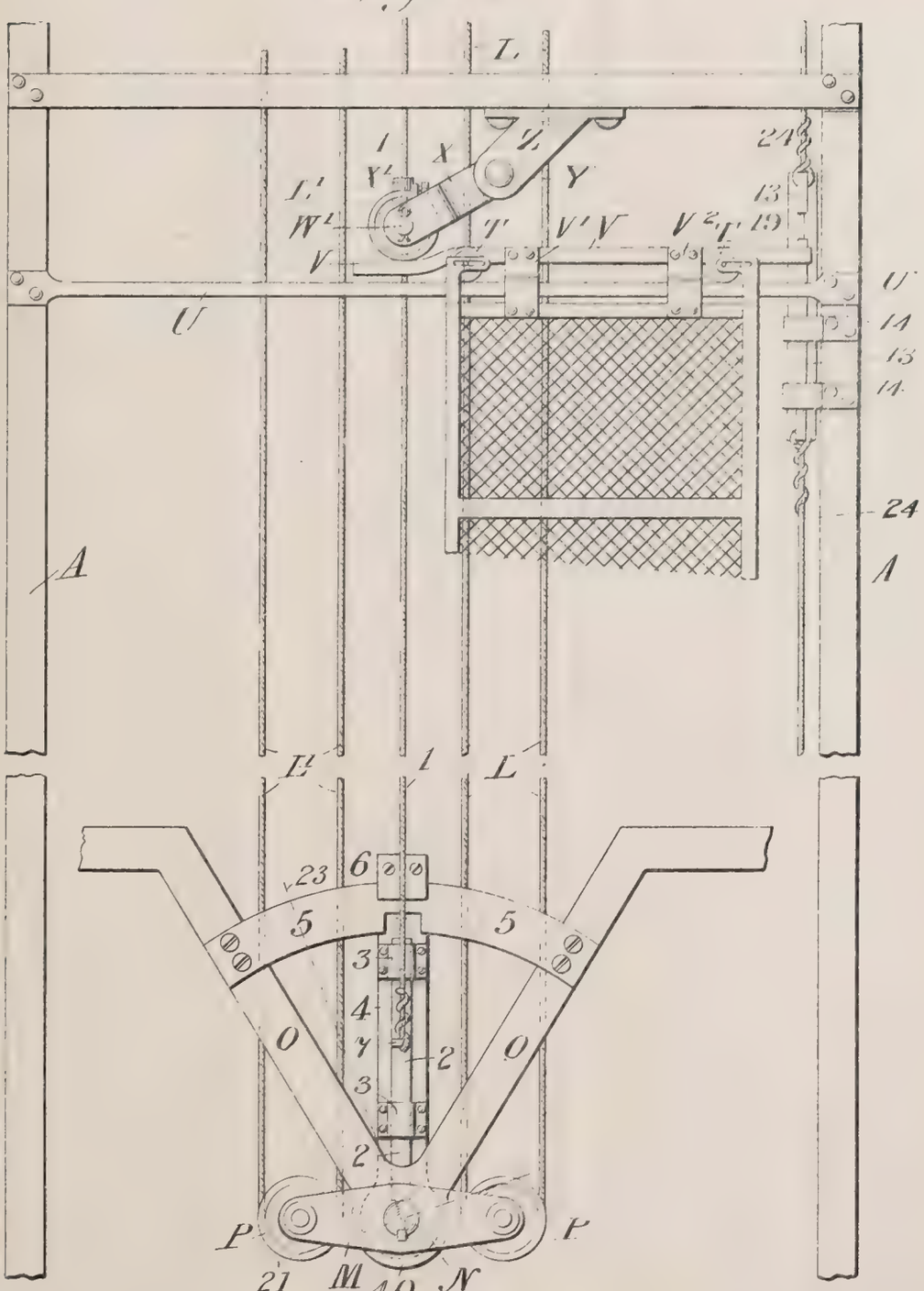
(No Model.) 3 Sheets—Sheet 2.

A. C. HUNT.

LOCKING MECHANISM FOR ELEVATORS.

No. 564,884. Patented July 28, 1896.

Fig. 1a.



Witnesses.

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Jos. W. Stearns

Inventor.

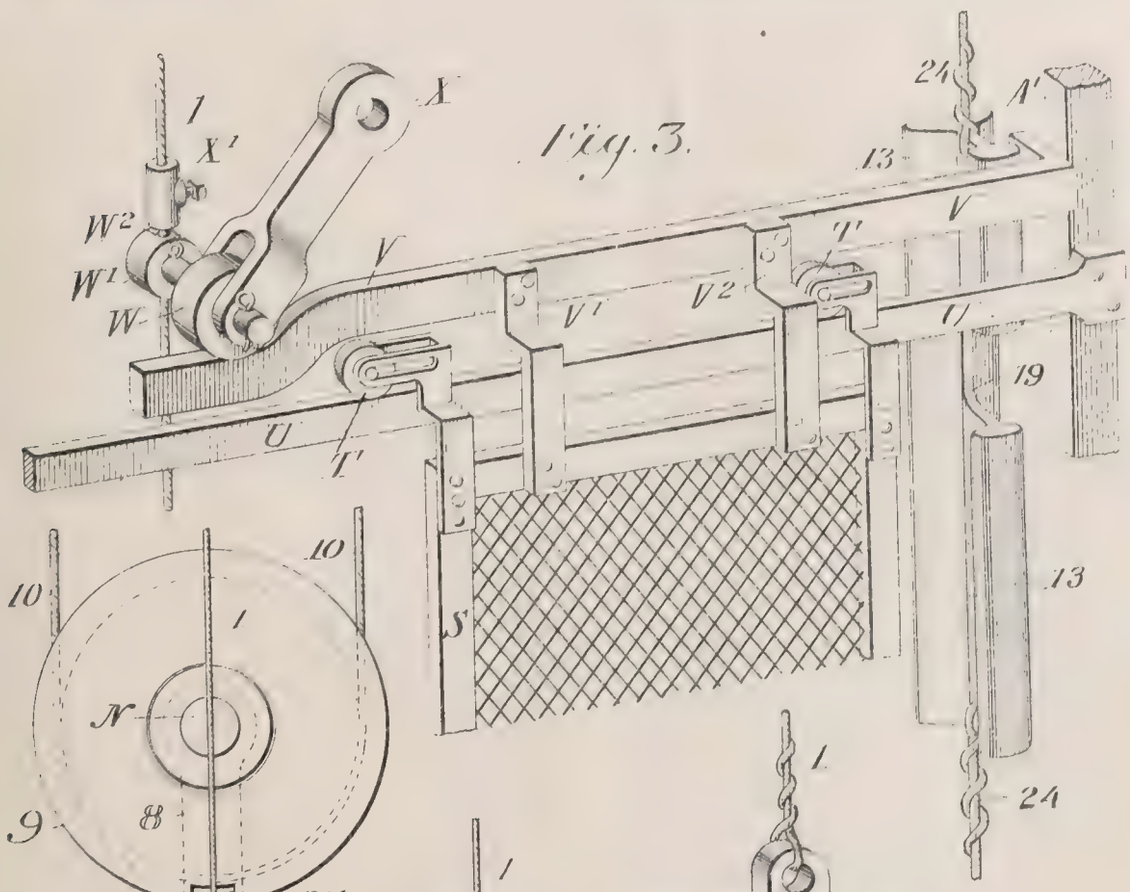
Albert C. Hunt

(No Model.) 3 Sheets—Sheet 3

A. C. HUNT.

LOCKING MECHANISM FOR ELEVATORS.

No. 564,884. Patented July 28, 1896.



Witnesses.

A. G. McInerney

Jos. W. Stearns,

Inventor.

Albert C. Hunt

UNITED STATES PATENT OFFICE.

ALBERT CAMERON HUNT, OF DENVER, COLORADO, ASSIGNOR TO JOEL W. STEARNS, OF SAME PLACE.

LOCKING MECHANISM FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 564,884, dated July 28, 1896.

Application filed December 26, 1895. Serial No. 573,401. (No model.)

To all whom it may concern:

Be it known that I, ALBERT CAMERON HUNT, a citizen of the United States of America, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Locking Devices for Elevator-Controlling Mechanisms and Elevator-Doors; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in automatic elevator-door and elevator-controlling-mechanism locks; and the objects of my invention are, first, to provide an automatic lock for elevator-doors; second, to provide a lock operating independently of the operating and controlling lever; third, to provide a lock which will lock the operating mechanism against operative movement by the operator until the elevator-door is closed; fourth, to provide means for automatically locking and relieving the doors of elevators controlled by either the lever or pull-rope systems; fifth, to provide a system of locking a plurality of elevator-doors which will lock all the doors and keep them locked, except when the car is in loading and unloading position opposite a door at a landing, and will then only release the door at the landing at which the car is, and will lock the operative mechanism of the car the moment the door is started open and will hold it locked until it is closed. I attain these objects by the mechanism illustrated and described in the accompanying drawings and specifications, in which—

Figures 1 and 1ª represent a vertical elevation of my improved elevator-door lock, showing its attachment to elevators operated by the lever system. Fig. 2 represents a modification of the lower terminal of the means for controlling elevators known as the "rope system." Fig. 3 represents a fragment of the locking mechanism of an elevator-door. Fig. 4 represents a fragment of the locking mechanism of the lower terminal of the elevator-operating mechanism. Fig. 5 represents my locking device adapted to an electric elevator.

Similar letters and figures of reference refer to similar parts throughout the several views.

Referring to Fig. 1, A designates posts at the corners of an elevator-well hole B. C designates an elevator-car suspended therein by a rope D, which passes over a pulley E and is connected with a suitable power device.

F designates a floor or elevator-landing.

G designates the floor of the car. To this floor is secured the operating mechanism of the lever system of operating passenger-elevators. It consists of the locking-segment bracket H, which is bolted to the floor, the lever I, which is secured rigidly to the shaft J, which is also supported in suitable bearings secured to the car-floor, and the rock-arm K. This rock-arm is also keyed to the shaft. To the ends of the rock-arm are secured the ends of ropes L and L′, which extend to the rock-arm M, which is keyed to a shaft N. This shaft is connected with mechanism which is adapted through the medium of the lever I in the car to raise and lower and start and stop the elevator in the elevator-well.

O designates a support for the shaft N and rock-arm M.

The rope L passes around the sheave P, which is pivoted in the rock-arm M. It extends from this sheave up to the top of the elevator and around the sheave Q and descends from it to the top of the car, to which it is secured at the point R. The rope L′, which is secured to the opposite end of the rock-arm K, is arranged like rope L. It passes downward from the rock-arm K to and around the sheave P′, which is pivoted in the opposite end of the rock-arm M, and from it extends upward to the top of the elevator and around the sheave Q′ and down to the top of the car, to which it is secured at point R′. Each rope extends in a continuous piece from each end of the rock-arm K to the top of the car. The mechanism just described constitutes substantially the lever system of controlling elevator-cars in common use.

I will now describe my improved locking mechanism and its application to it.

S designates a door at a floor or landing

leading into the elevator-well and into the elevator-car when it is opposite it, as shown in Fig. 1. To the door rollers T are secured, which adapt it to run on a track U. This track is secured to the corner-posts A and A'. Above the track U, I place a second track V, securing it to the door by straps V' and V². This track extends beyond the door at both ends. At the rear edge of the door it is curved downward a few inches to form a curved or inclined step. It then continues for a short distance approximately parallel with its main portion and with the door. The opposite end has a portion of the end bent at right angles to its length inwardly toward the center of the elevator-well, for a purpose which will be hereinafter described. A roller W rests normally on the extreme opposite end of the track and is adapted to run up the step and on the track when the door is pushed open. The roller or sheave W is pivoted by a pin W' in an arm X, one end of which is bifurcated to receive it. The opposite end is pivoted by a bolt Y to a support Z, which is secured to the posts A and A' of the elevator-way or to its front inclosure, which is not shown. One end of the pin W' is enlarged and a hole W² is made through it. (See Fig. 3.) Through this hole the rope or wire 1 passes and continues over a sheave W³, which is pivoted to the elevator inclosure. A small weight W⁴ is attached to its end to keep it taut. This wire or rope extends to a sliding bolt 2, to which it is also secured. The rope, however, passes through the pivoting-pin W' of an arm similar to arm X, which is secured in operative relation to each door on every landing or floor of the elevator-well, as every door opening into the elevator-well and into the car is arranged the same. A fragment of the door S on the floor below the one the car is represented to be at is shown in Fig. 1. On the wire or rope 1 I secure clips or stops X'. These consist of pieces of metal provided with a central hole through which the rope passes, and a set-screw for securing them to it. The clips are secured to the wire in positions to rest on the tops of the pins W' of each arm. Consequently if any one arm is raised by its door being rolled back it will carry the clip and the rope up with it, but the rope will slide through the pins of the other arms and the weight W⁴ will keep it taut above the arm raised. The sliding bolt 2 is secured freely by clips 3 to an arm 4, which is keyed to the shaft N. A segment 5 is secured to the support O, concentric with said shaft. The arm extends to the segment and is arranged to slide along one side of it and lap over its top edge flush with the side opposite the one it slides on. A plate 6 is secured to its top to project down the side of the segment, thus securing the arm to it against displacement, but allowing it freedom to oscillate on it as the shaft is oscillated by the controlling-lever in the car. I cut a recess in the segment, arranging it in vertical alinement with the axis of the shafts J and N and the controlling-lever in the car. The recess is adapted to receive the upper end of the bolt 2, the latter to fit very freely in it. A projection 7 is provided on the bolt 2 to secure the lower end of the rope.

In Fig. 2 I illustrate the lower terminal of the pull-rope system. The shaft N is loosely secured to a bar 8, the opposite end of which is secured to a suitable foundation. The bar 8 is placed close to one side of the sheave 9, around which the operating rope 10 passes. The sheave is secured to the shaft N. On the bar 8 a sliding bolt 11 is secured by clips 12, in which it is free to move vertically. A recess N' is cut in the periphery of the sheave which is adapted to receive the upper end of said bolt. This recess is made considerably larger than the bolt, as the movement of the rope by the operator in the car is not defined by fixed stops, as in the case of the lever system. The lower end of the rope 1 is secured to the bolt 11 in a manner similar to that shown in Figs. 1 and 4. The arrangement of the elevator-doors for this system, as well as for electric systems, is exactly the same as for the lever system.

To adapt my locking device to electrically controlled and operated elevators it is only necessary to arrange the device at the bottom end of the rope 1 to break the electric circuit which operates and controls the elevator-car. There are several ways of doing this, but I preferably carry out this feature of my invention in the following manner: Referring to Fig. 5, K' designates a support on which the sliding bolt or plug K² is secured to move freely, vertically, by the clips K³. This sliding bolt or plug is made of conductive metal. At its lower end K⁴ it is enlarged and then beveled and converged to a point. Through the point one end of a rebounding spring K⁵ is secured, the opposite end of which is secured to a boss K⁶ on the support K'. K⁷ and K⁸ are oppositely-disposed contact-terminals connected in an electric circuit of which the wire K⁹ is a fragment. This circuit is the operative circuit of the elevator. The terminals K⁷ and K⁸ are provided with edges beveled to receive and fit against the beveled edges of the plug K², as shown in Fig. 5, in which position the circuit is closed. To the top of the plug the rope 1 is secured. When the rope is lifted by the opening of a door by the operator, and its pivoted arm is raised, together with the rope, this plug is also lifted up away from the terminals, which breaks the circuit. When the door is closed by the operator, the spring, which is expanded by raising the plug, rebounds and draws the plug down against the edges of the terminals and again closes the circuit. As this current-breaker is inserted in the elevator operating and controlling curcuit, the car cannot be moved by the operator until the circuit is closed, when he has once started to open a door, and until he closes the door the con-

trolling mechanism is inoperative, but is rendered operative the moment the plug drops into the terminals by the closing of the doors.

The end of the track V, which is turned sidewise, rests on and its bent end extends over a bar 13, preferably made of T-iron. This bar I term a "locking-bar." It is supported by suitable bearings 14, which are secured to the post A', or to parts of the inclosure of the elevator-well. This locking-bar travels up and down freely in its supports in the elevator-well, being arranged to always move in the same direction as the elevator-car, but it is arranged to move but a fraction of the distance traveled by the car. Consequently it need be but about a foot or two in length.

At each landing, opposite the ends of the track, a locking-bar is placed in operative relation to receive the hooks of the track. The bars are connected together by a rope 24, which extends from the upper one to a sheave 15, around which it is wrapped and the end fastened to it. This sheave is also provided with a sprocket-teeth portion, which is placed to one side of the rope-tread of the sheave, and a sprocket-chain 16 runs from it to a small sprocket-pinion 17, secured to the shaft 18, which supports the car-sustaining cable D. The proportion of the diameter of the sprocket-pinion to that of the sprocket-sheave is such that the travel of the car in the elevator-well and the revolutions of the sprocket pinion and sheave 15 to make this travel are reduced to a rotative movement of one or more, or of only a partial revolution of the sheave-wheel 15. This slight movement of the sheave-wheel operates to move the locking-bars but a fraction of the distance the elevator-car travels in the elevator-well. In each one of the locking-bars a recess 19 is cut through the tread and web portion wide and deep enough to allow the bent end of the track to pass very freely through. These recesses are arranged in the locking-bars intermediate of their ends at predetermined varying distances, successively arranged from floor to floor of the elevator-well, relatively to the travel of the elevator. This at the top floor the recess 19 registers with the track V and the door can be opened, but at the door below the slot is above the track, and the end of the track hooks over the locking-bar and locks the door at the landing closed as well as all doors below it.

The operation is as follows: When the operator shifts the controlling-lever I to lower the car, one end of the rope L is raised and the same end of the rope L' on the opposite end of the rock-arm K is lowered. The rock-arms K and M and shafts J and N are also partially rotated, which moves the arm 4 on the segment 5 at the lower terminal, the two rock-arms, the controlling-lever, and the arms assuming the positions of the dotted lines 20, 21, 22, and 23; but when the car is stopped at a landing the controlling-lever is brought to the center and fastened in a vertical position to its locking-segment, and the various parts aline themselves as represented in Fig. 1. The operator then rolls back the door, which is unlocked free from the locking-bar, as the recess of the locking-bar at that landing is in position to register with the end of the track U and it can pass through it as the door is rolled back. The minute the door starts back the track V raises the roller up the step onto the main portion. When the roller is lifted by the track, the rope 1 is also lifted, and also the bolt 2, which slides upward in the clips into the slot in the segment and prevents the shaft N and the rock-arm 4 from being moved by the controlling-lever in the car, as the operator cannot move it far enough to start the operating mechanism until the door is closed, which allows the roller and its supporting-arm and the rope to drop, and consequently the bolt 2, which is heavy enough to drop and rest on the shaft when the rope is slacked.

When a rope-lifting arm is raised by a door that is being opened, the other rollers and their supporting-arms are not raised, and the wire moves through the holes in their pivoting-pins, and the doors both below and above are not released, as the slots in their respective locking-bars do not come opposite the hooked end of the track V. The rope-lifting rollers and arms above any landing at which the car is stopped are not affected, as the rope 1 is simply slacked and they cannot be opened, as the slots in their locking-bars do not register with the hooked end of the track. Consequently only the door of a landing at which a car is stopped can be opened, and the controlling-lever and operating mechanism are also locked when a car is stopped at a landing from the time the operator commences to roll the door open until he closes it.

This locking mechanism is very simple, durable, and effective, and that portion of it which locks the controlling mechanism can be applied to elevators in use which are already equipped with some form of door latching and locking mechanism. The [illegible] ing mechanism can also be applied [illegible] doors already provided with [illegible] for the controlling [illegible] doors not equipped with [illegible] mechanism, they [illegible] conjunctively; and [illegible] the preferred construction and arrangement of my locking mechanism. I do not wish to be limited strictly to it, as [illegible] tions of its parts might be made without departing from the principle of my invention.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with the elevator-car and controlling mechanism of an arm secured to the lower terminal shaft of the controlling mechanism, a fixed segment in engagement with said arm, a sliding bolt on said arm, said

segment having a notch adapted to receive said sliding bolt, a track secured to each door and movable therewith, having a downward stepped portion at its rearward end, a roller normally in engagement with the step portion of said track and in the path of its main portion, an arm supporting said roller and pivoted to the elevator inclosure, and a rope connecting said roller and said sliding bolt whereby when the door is opened, the controlling mechanism is locked against manipulation by the operator, substantially as described.

2. The combination in an elevator-locking mechanism, of the doors each having a track secured thereto, a pivotal arm carrying a roller and arranged in the path of said door-track, and adapted to be raised thereby, the rope secured to said arms and adapted to be raised by any one arm while the others remain in their normal state of rest, as its respective door is opened and closed, the arm secured to the lower terminal of the controlling mechanism, the fixed segment and the sliding bolt adapted to be raised by said rope and lock the said lower terminal of said controlling mechanism to said segment, substantially as set forth.

3. The combination in an elevator-locking mechanism, of the doors, the tracks secured thereto, the pivoted arms, the rollers thereon, the pivoting-pins, the rope and the adjustable clips.

4. The combination in an elevator-locking mechanism, of the doors, the rope suspended in the elevator-way, the adjustable rope-raising clips secured thereto, arms pivoted to the elevator inclosure at each landing in operative relation to said clips, means secured to said door for raising said arms when the doors are opened, and means substantially as described connected to the lower end of said rope for locking the lower terminal of the controlling mechanism.

5. In an elevator-locking mechanism the combination with the car's controlling mechanism and the elevator-inclosure doors, of a rope suspended in the elevator-well, an arm pivoted at each floor in the opening path of the doors, rollers pivoted to said arms, there being an opening through said roller-pivot through which said rope passes, adjustable stops on said rope arranged and adapted to be engaged by said arms to lift said ropes, a track secured to each door, a stepped portion on which said rollers normally rest, a higher portion upon which said rollers are adapted to be raised and retained while its respective door is open, an arm secured to the shaft of the lower terminal of the controlling mechanism, a fixed segment to which said arm is slidably secured to oscillate, a notch in said segment in vertical alinement with the said shaft, and with the stop-locking axis of the controlling-lever in said car, a sliding bolt on said arm in operative relation to the slot in said segment, substantially as herein set forth.

6. The combination with the elevator-well, the doors therein, the car and the controlling mechanism, of a track having a hooked end secured to each door in the elevator-well and movable therewith, the sliding bolt and operating-rope, the rope-raising arms arranged in operative engagement with said door-tracks, the bar and segment, a pinion sprocket-wheel secured to the shaft that supports the elevator-car, its carrying rope and sheave, a large combined sprocket-wheel and sheave having a predetermined ratio of diameter to said pinion journaled with its sheave-receiving tread approximately parallel with the side of the well adjacent to the front edge of the elevator-doors, a rope or wire encircling the sheave portion of said combined sheave and sprocket-wheel, and extending to the lower landing of the elevator-well, a locking-bar interposed in the said rope or wire at each floor or landing and positioned to engage the said hooked end of each of said tracks, a notch through each of said locking-bars adapted to release said hooked ends of said tracks and arranged in each locking-bar of each landing at predetermined points in relation to its respective track and the travel of the elevator-car, and a sprocket-chain connection between said sprocket-pinion and the sprocket-wheel of said combined sprocket-wheel and sheave, whereby the locking-bars are raised and lowered in unison with said car, but at a predetermined fraction of the distance of the car's travel, as set forth.

7. The combination in an elevator-locking mechanism, of the doors, the track secured to each door and movable therewith, the pivotal arms, the rollers therein arranged to be operatively engaged by said tracks, the pivoting-pins of said rollers adapted to freely support the operative rope of the locking-bolt, the locking-bolt-operating rope, the car-controlling ropes, the lower terminal locking device at the lower end of said ropes, and means secured to said car-operative rope of the locking-bolt and adapted to coöperate with said arms whereby any one arm may lift said rope while the other arms remain in a state of rest, as specified.

8. The combination in an elevator-locking mechanism, of the inclosure-doors having each a track movable therewith, means substantially as described for locking the controlling mechanism by the reciprocative movement of said doors, and for locking said mechanism by said movement of any one door independent of the others, a hooked end on each track at the entrance end of said doors, a vertically-sliding locking-bar arranged in operative relation to each door and in operative engagement with the hooked end of each door's track and adapted to lock each door closed independent of the others, suitable supports for said locking-bars, a slot in each locking-bar adapted to move in a position to register with said hooked end of said door-tracks and arranged in each locking-bar at predeter-

mined points of its vertical movement, relative to the position of the car in respect to each, whereby each door in its turn is released from its locking-bar when the car is at its respective landing, and a differential power connection between the elevator and said locking-bars whereby they are moved conjunctively and in unison with said car, and the said locking-bars are moved at a predetermined fraction of the distance traveled by the elevator-car, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ALBERT CAMERON HUNT.

Witnesses:
ADAM G. MCCHESNEY,
JOEL W. STEARNS.

(No Model.) 2 Sheets--Sheet 1.

W. C. FAHY.

LOCKING ATTACHMENT FOR ELEVATORS.

No. 565,889. Patented Aug. 18, 1896.

fig. 1.

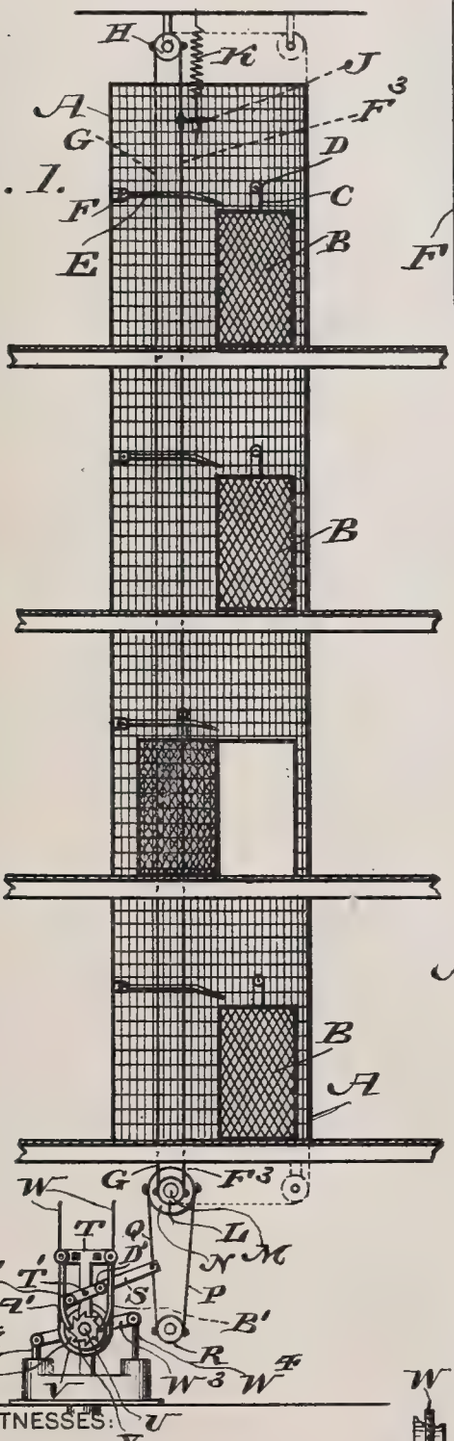


fig. 2.

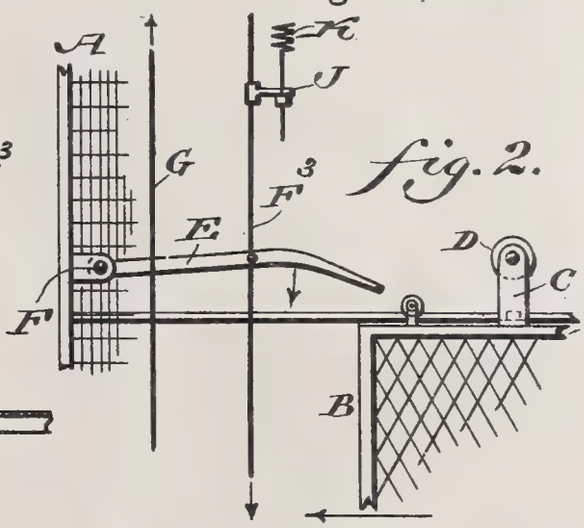


fig. 3.

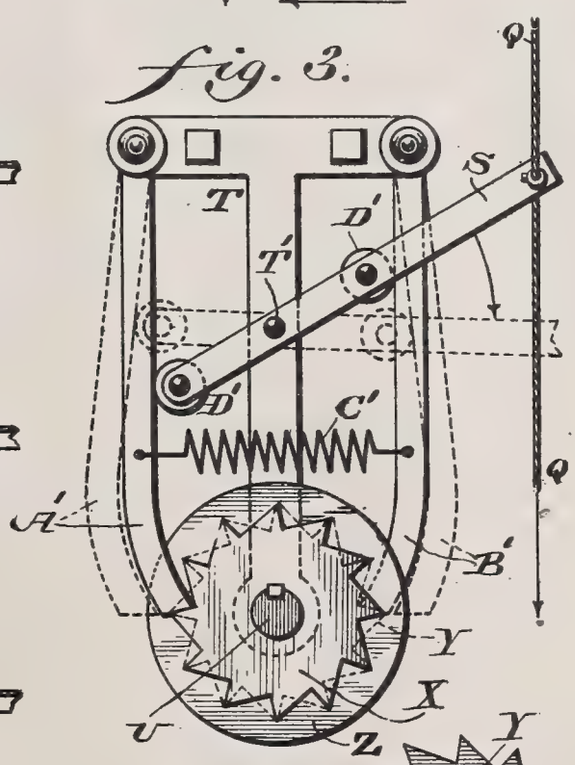


fig. 5.

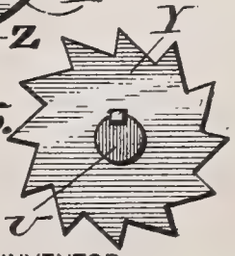
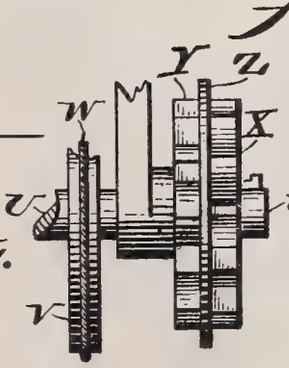


fig. 4.



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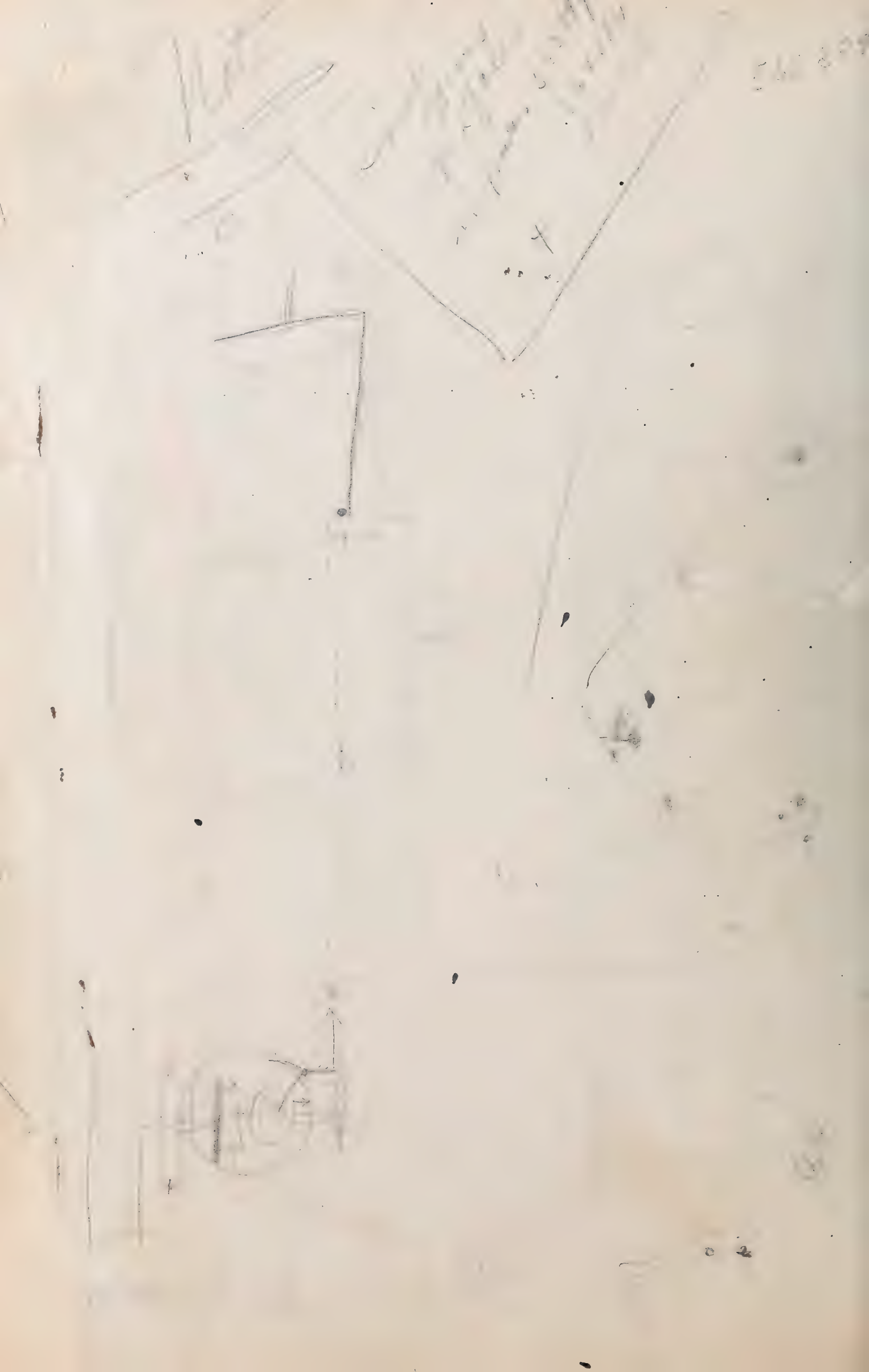

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W. C. FAHY.

LOCKING ATTACHMENT FOR ELEVATORS.

No. 565,889. Patented Aug. 18, 1896.

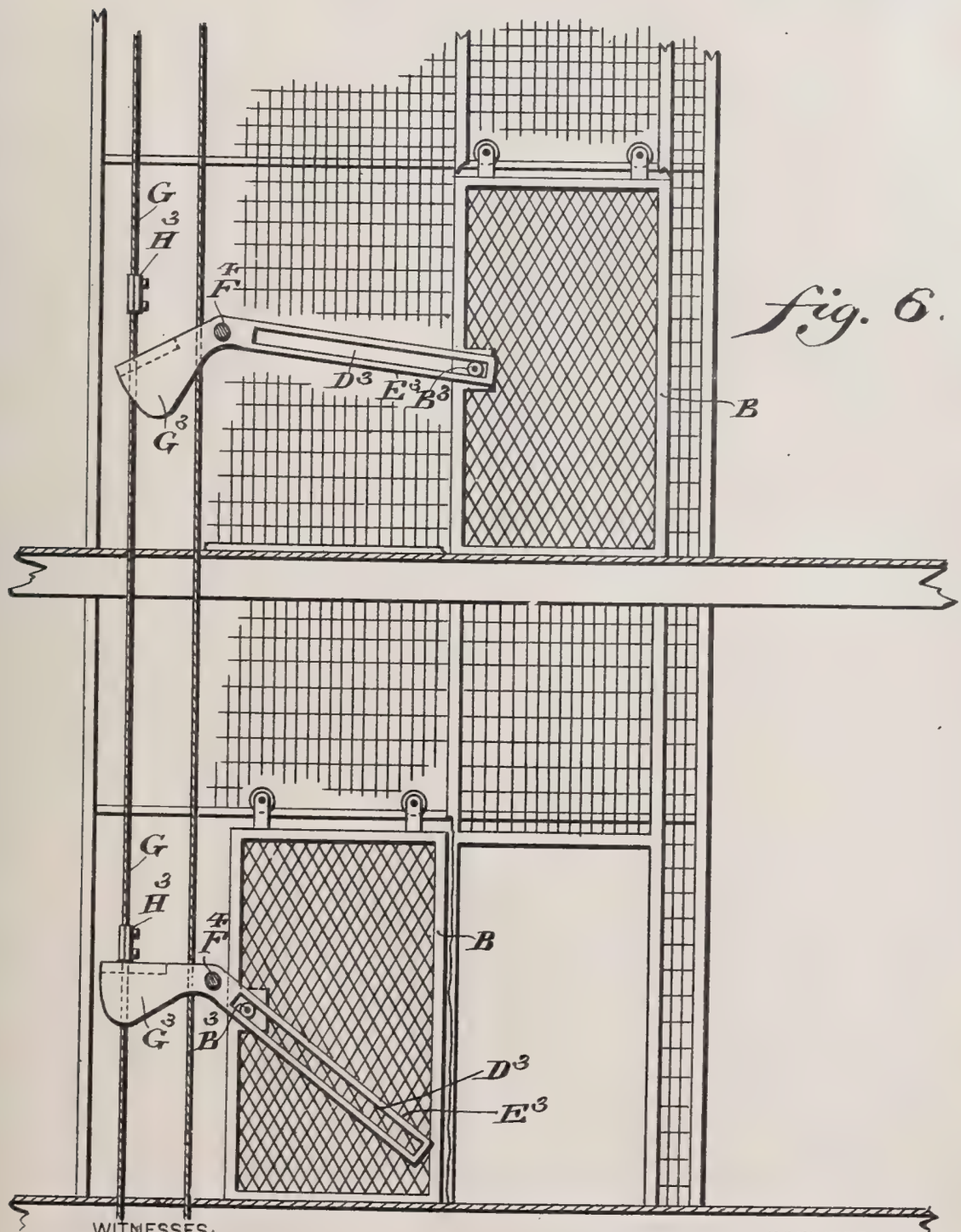

fig. 6.

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UNITED STATES PATENT OFFICE.

WILLIAM C. FAHY, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE ELEVATOR SAFETY CONTROLLER COMPANY, OF SAME PLACE.

LOCKING ATTACHMENT FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 565,889, dated August 18, 1896.

Application filed February 5, 1896. Serial No. 578,074. No model.

To all whom it may concern:

Be it known that I, WILLIAM C. FAHY, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Locking Attachments for Elevators, which improvement is fully set forth in the following specification and accompanying drawings.

My invention relates to elevators; and it consists of a novel construction of locking attachment, which is automatically operated by the opening and closing of the elevator-doors, whereby provision is made for locking the starting and stopping mechanism when said doors are open.

It further consists of a novel construction of locking devices for an elevator-door, which are automatically operated by the car, so that said door is held in locked position until the car reaches a predetermined point in its travel.

It further consists of novel details of construction, all as will be hereinafter set forth, and specifically pointed out in the claims.

Figure 1 represents a side elevation of an elevator-well provided with locking devices embodying my invention. Fig. 2 represents, on an enlarged scale, a side elevation of a portion of the mechanism whereby the locking device is actuated upon the movement of the door. Fig. 3 represents, on an enlarged scale, a side elevation showing the mechanism in the lower portion of the elevator-well for locking and unlocking the starting and stopping devices. Fig. 4 represents, on an enlarged scale, a side elevation of a portion of the actuating mechanism. Fig. 5 represents a side elevation of a portion of Fig. 4, showing the ratchet employed therein. Fig. 6 represents, on an enlarged scale, a side elevation of a modified form of door-actuating mechanism employed.

Similar letters of reference indicate corresponding parts in the several figures.

Referring to the drawings, A designates an elevator-well, the same being provided with the doors B, which are hung and constructed in the usual manner. These doors serve as a support for certain new and useful devices which form part of my invented device and will further be described in detail. These devices form a portion of the means for actuating the locking mechanism, and since the construction of door and devices is substantially the same a description of one will suffice for all, reference being had to Fig. 2 and the upper portion of Fig. 1.

C designates a bracket mounted upon the sliding door B, in which is journaled the roller D, which is adapted to contact with a lever E when the door is opened, said lever being fulcrumed at F and in the present instance having its free end slightly depressed, so as to readily be engaged by said roller D. F^2 designates a chain, cord, cable, or other connection which is attached to each of said levers E, and which passes over the sheaves H, which are journaled at the upper portion of the elevator-well, said connection F^2, after passing around said sheaves H, being designated by the letter G. J designates an arm projecting from said connection F^2, which has attached thereto one end of a spring K, the other end of the latter being secured to a suitable part of the wall of the elevator-well, as will be evident from Fig. 1.

L designates a pulley, which is mounted upon a rotatable shaft M, which is supported in the lower portion of the elevator-well, said shaft carrying a drum N, around which the ropes P and Q pass, the same also passing around the drum R, it being understood that the ropes F^2 and G pass around the pulley L.

In the preferred form of my invention I attach the connections F^2 and G, respectively, to the pulleys H and L by means of the pins, screws, or similar devices seen in Fig. 1, so that any movement imparted to any one of said connections will be positively transmitted to the other, the connections Q and P being attached, respectively, to the drums N and R in the same manner, as will be evident from the lower portion of Fig. 1.

No particular form of controlling mechanism is essential to my invention. In the form shown in the drawings, Q is attached to the end of the lever S, which is fulcrumed at the point T to the frame T, as is best seen in Figs. 1 and 3, the lower portion of said frame

having journaled therein the shaft U, which has mounted thereon the pulley V, around which the controller-cables W pass, which latter are actuated by the attendant, by means of suitable intervening mechanism, from the elevator-car, and since the invention is limited to no special construction of actuating mechanism a detailed description of the same is omitted.

Describing now a form of starting and stopping mechanism, W^3 designates a lever or walking-beam which is mounted upon the shaft U, and is connected by means of the rods W^4 to suitable valve mechanism, whereby the elevator is started or stopped according to whichever end of the walking-beam W^3 is elevated or depressed, the construction of said valve mechanism forming no part of the present invention and therefore does not need to be referred to in detail.

X and Y designate ratchet-wheels which are mounted upon the shaft U, said wheels being separated from each other by the partition Z, it being understood that the teeth of said ratchet-wheels are turned in opposite directions to each other when the parts are assembled, as will be evident from the dotted lines in the lower portion of Fig. 3.

A′ B′ designate pawls which are pivotally attached to or depend from the upper portion of the frame T, and have common thereto the spring C′, the tendency of which is to draw said pawls toward each other, whereby the extremities of the same are yieldingly urged into contact with the ratchet-wheels X and Y.

D′ designates rollers mounted at substantially equal distances upon the lever S on each side of the fulcrum T′, said rollers being adapted to contact with suitable portions of the pawls A′ B′, whereby it will be seen that when said lever S is in an inclined position, as seen in Figs. 1 and 3, the pawls will be held in engagement with their respective ratchet-wheels by the spring C′, but when said lever is rocked into the position shown in dotted lines in Fig. 3 the levers will also be caused to assume the position shown in dotted lines, and the pawls, and consequently the operating mechanism, can be readily actuated.

The operation is as follows: If we assume a door to be open, as indicated at B^4 in Fig. 1, it will be seen that the contact of the roller D with the lever E has depressed the same, and by reason of the intermediate connections the lever S has moved into the position seen in full lines in Figs. 1 and 3, thereby allowing the spring C′ to draw the pawls A′ B′ toward each other into engagement with the ratchet-wheels X and Y, whereupon it will be seen that the shaft U cannot be operated by means of the controller-cables W in either direction, and the car is therefore held in fixed position so long as any of the doors remain open, as at B^4. If now the door is closed, the parts will assume the position shown in dotted lines in Fig. 3, since the spring K now exerts a pull on the connection F^3, and causes, through the medium of the intermediate connections, the lever S to assume the position seen in dotted lines in Fig. 3, thereby throwing the pawls A′ B′ out of engagement with their respective ratchets X and Y, and the shaft U can now be readily rotated by the proper mechanism, and the walking-beam W^3, its valve mechanism, and adjuncts can be operated in the desired direction to cause the ascent or descent of the car.

In Fig. 6 I have shown a modified construction of door-operated mechanism which may be preferably employed in some locations, B designating the door as before, upon a suitable portion of which is mounted the roller B^3, which engages the walls of the slot D^3 in the bar E^3, which is fulcrumed at F^4, and has an arm G^3, which is adapted to contact with a block H^3, attached to the connection G, whereupon it will be seen that the opening or closing of the door will impart the desired movement to the mechanism in the well for operating the valves, the parts being restored by means of springs or similar devices.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of suitable starting and stopping mechanism for an elevator, a shaft for operating said mechanism, a series of elevator-shaft doors, a series of levers opposite said shaft-doors, means upon said shaft-doors for operating said levers, a lock device having one of its members positively connected to said shaft so as to rotate therewith, and connections between said levers and the other member of said lock device substantially as described.

2. The combination of suitable starting and stopping mechanism for an elevator, a shaft for operating said mechanism, a series of elevator-shaft doors, a series of levers opposite said shaft-doors, means upon said shaft-doors for operating said levers, a pawl-and-ratchet locking device having the ratchet portion positively secured to said shaft, and connections between said lever and the pawl member of the locking device, substantially as described.

3. In an elevator the combination of the elevator-shaft doors levers adapted to be operated by the movement of said doors, the starting and stopping mechanism, a ratchet-wheel connected with said starting and stopping mechanism, pawls adapted to engage said ratchet-wheel connections between said levers and said pawls and a spring tending to move said connections in one direction and the movement of said levers when acted upon by the doors moving said connections in the opposite direction substantially as described.

4. The combination of suitable stopping and starting mechanism for an elevator, a shaft for operating said mechanism, a series of elevator-shaft doors a locking device having a plurality of ratchet-wheels mounted upon

the shaft of said mechanism, pawls engaging with said ratchet-wheels, a spring adapted to hold said pawls, a lever suitably fulcrumed and having rollers contacting with said pawls and adapted to move the said pawls in and out of engagement with said ratchet-wheels, and means operated by said shaft-doors for rocking said lever substantially as described.

5. The combination in an elevator locking attachment, of starting and stopping mechanism a pair of ratchet-wheels revolving together and having the teeth of one set in the reverse direction to the teeth of the other, said ratchet-wheels being connected with said starting and stopping mechanism pawls pivotally secured and provided with yieldingly-acting devices urging them into engagement with said ratchet-wheels and means acting positively upon said pawls to disengage them from said ratchet-wheels shaft-doors and means operated by said shaft-doors for operating the means acting positively upon the pawls substantially as described.

6. The combination, in an elevator locking attachment, of starting and stopping mechanism a pair of ratchet-wheels secured upon the shaft of said starting and stopping mechanism and secured to each other and having their teeth set in opposite directions a pawl for each ratchet-wheel, freely movable toward and away from same, means for yieldingly urging said pawls toward said ratchet-wheels and means for positively withdrawing them from engagement with same, shaft-doors and means operated by said shaft-doors for operating the means for positively withdrawing the pawls from engagement with the same substantially as described.

7. The combination, in an elevator locking attachment, of starting and stopping mechanism a pair of ratchet-wheels having their teeth set in opposite directions, said ratchet-wheels being connected with said starting and stopping mechanism a disk set between said ratchet-wheels of greater diameter than said ratchet-wheels, a pawl for each ratchet-wheel freely movable toward and away from same, a spring yieldingly impelling said pawls into connection with said ratchet-wheels and a lever pivoted between said pawls and provided with means for engaging with said pawls whereby said pawls are moved positively away from engagement with said ratchet-wheels shaft-doors and means for operating said lever operated by said shaft-doors substantially as described.

8. The combination, in an elevator locking attachment, of starting and stopping mechanism a pair of ratchet-wheels secured to and moving with each other and having their teeth set in opposite directions, said ratchet-wheels being connected with said starting and stopping mechanism a pawl for each ratchet-wheel freely movable toward and away from same, a spring yieldingly impelling said pawls into connection with said ratchet-wheels and a lever fulcrumed at a point between said pawls and provided with rollers engaging with said pawls whereby said pawls are moved positively out of engagement with said ratchet-wheels shaft-doors and means for operating said lever operated by said shaft-doors substantially as described.

9. The combination in an elevator device of starting and stopping mechanism a locking device set upon a shaft positively connected with said starting and stopping mechanism, a series of levers hung at the doors of the elevator-shaft, said shaft-doors, means placed upon said doors for engagement with said levers, a sheave at the top of the shaft, a flexible connection passing round said sheave and positively connected to said locking device, and to said levers, substantially as described.

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Witnesses:
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(No Model.) 12 Sheets—Sheet 1.

C. A. HARKNESS.

ELEVATOR.

No. 569,129. Patented Oct. 6, 1896.

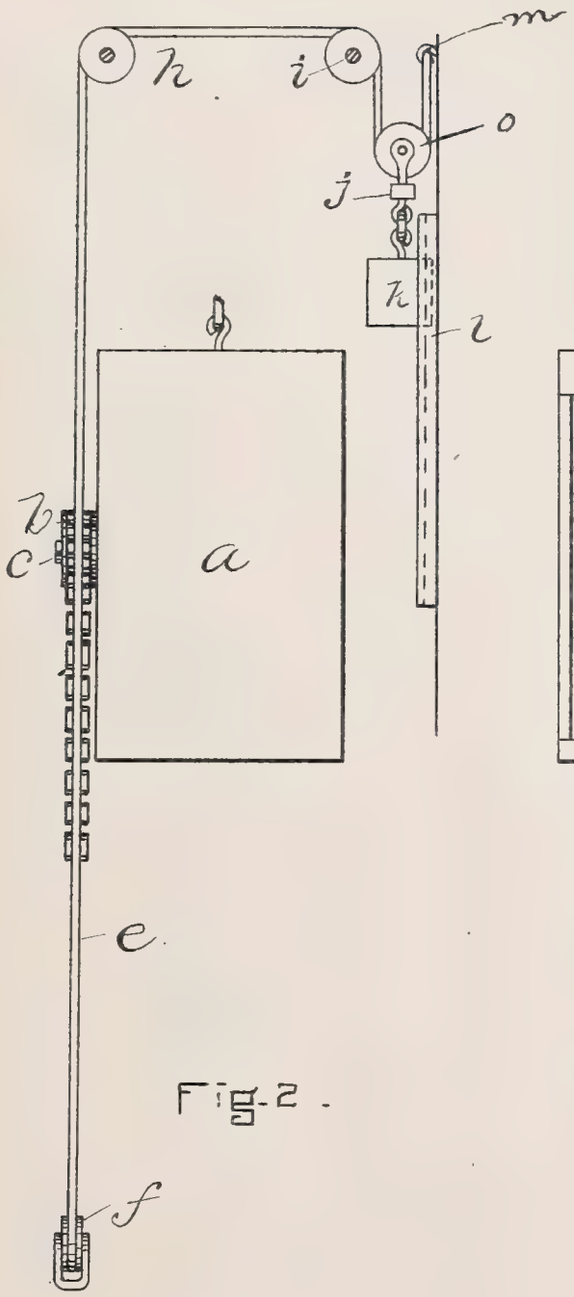

Fig. 2.

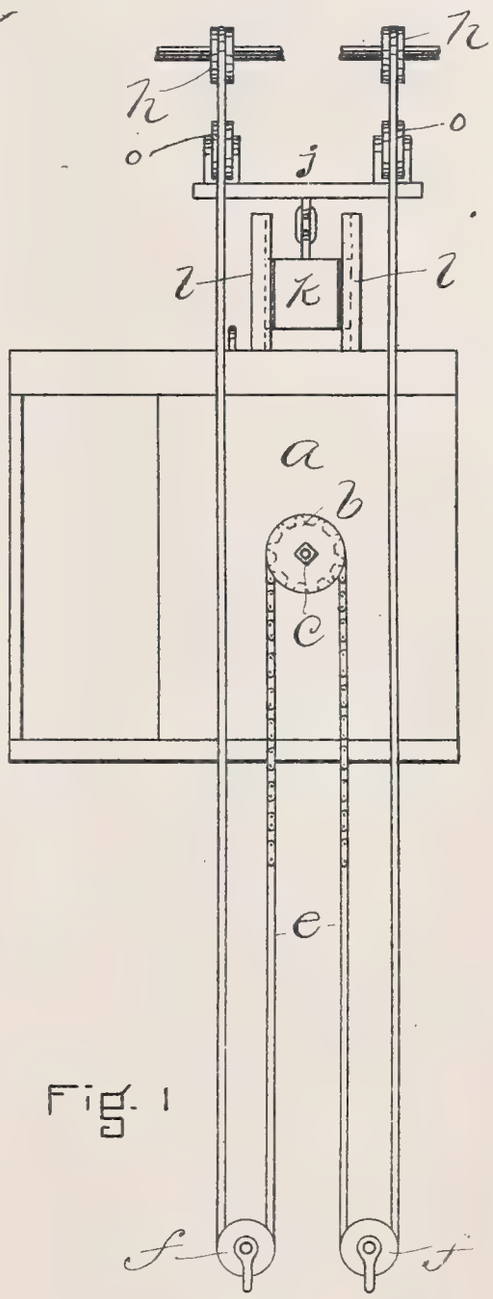

Fig. 1.

WITNESSES.

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Att'y.

(No Model.) 12 Sheets—Sheet 2.

C. A. HARKNESS.

ELEVATOR.

No. 569,129. Patented Oct. 6, 1896.

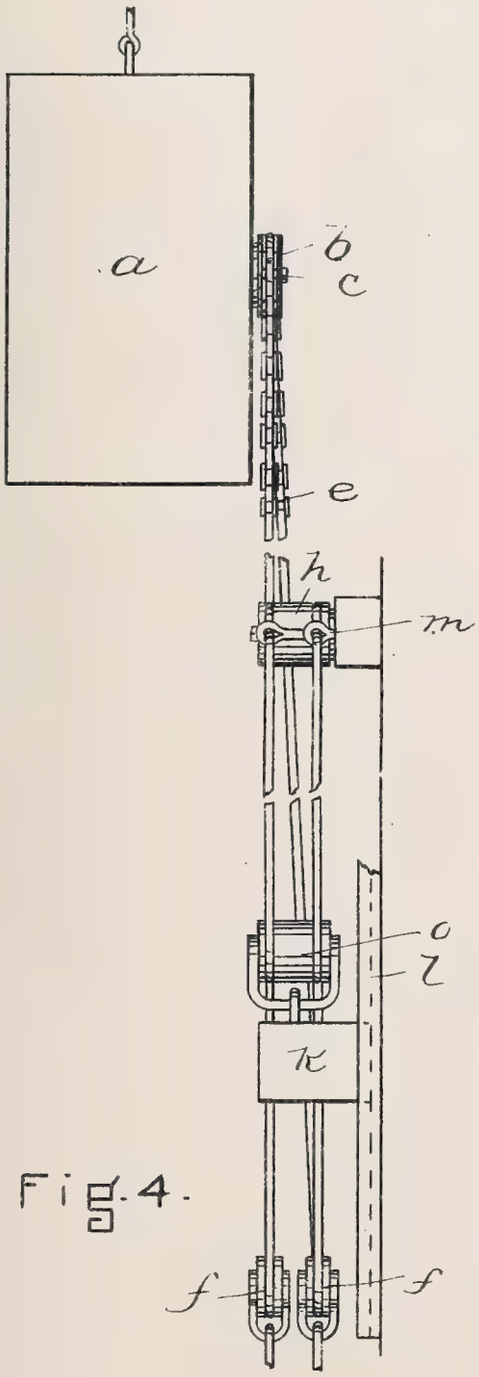

Fig. 4.

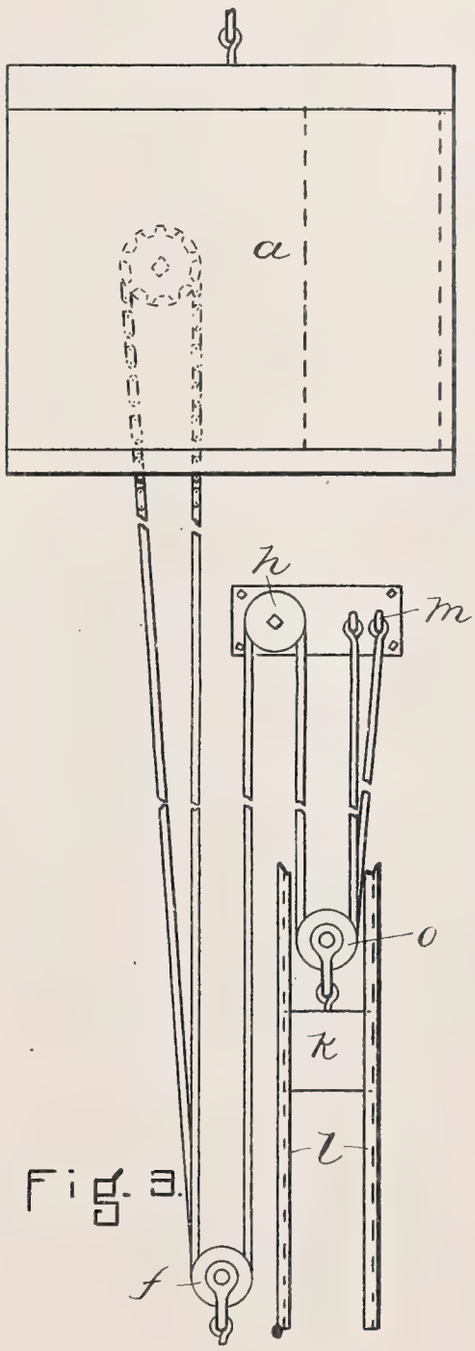

Fig. 3.

WITNESSES.

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Marcus B. Mayo

INVENTOR.

Charles A. Harkness

By

Arthur O. Crosby.

Atty.

(No Model.) 12 Sheets—Sheet 3.

C. A. HARKNESS.

ELEVATOR.

No. 569,129. Patented Oct. 6, 1896.

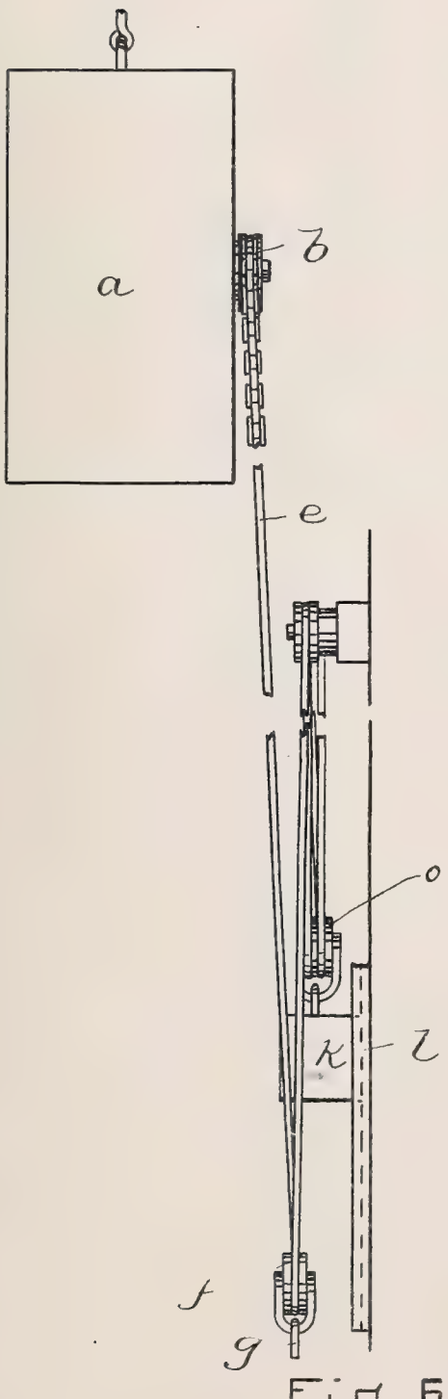

Fig. 6.

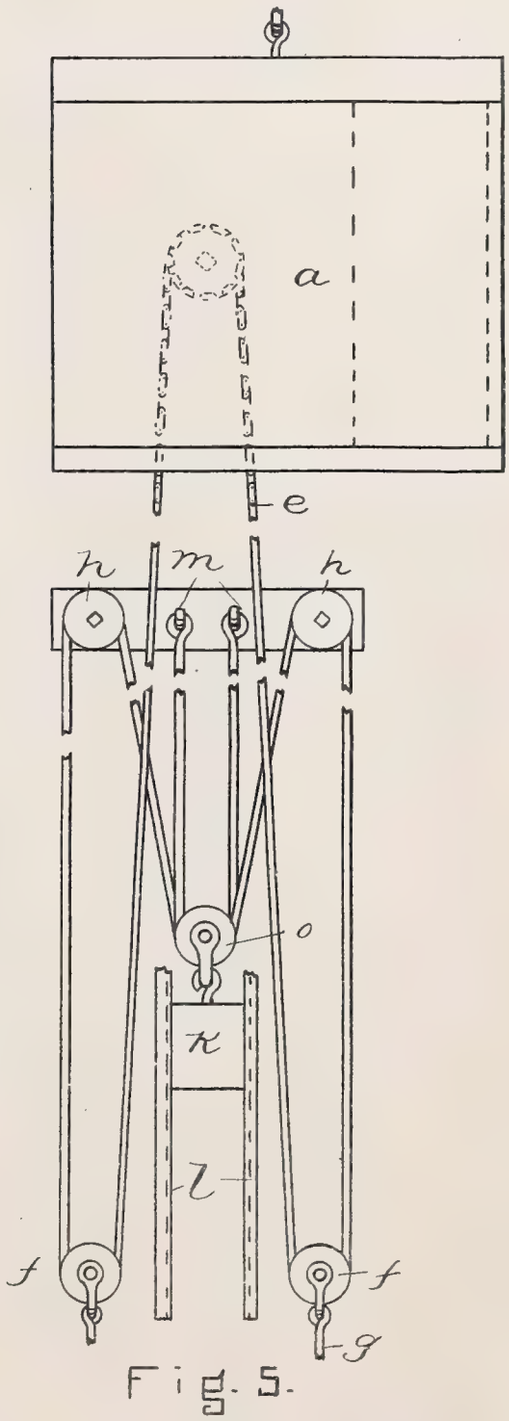

Fig. 5.

WITNESSES.

Matthew M Blunt.

Marcus B May

INVENTOR.

Charles A. Harkness

By Anthony W. Fossler,

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(No Model.) 12 Sheets—Sheet 4.

C. A. HARKNESS.

ELEVATOR.

No. 569,129. Patented Oct. 6, 1896.

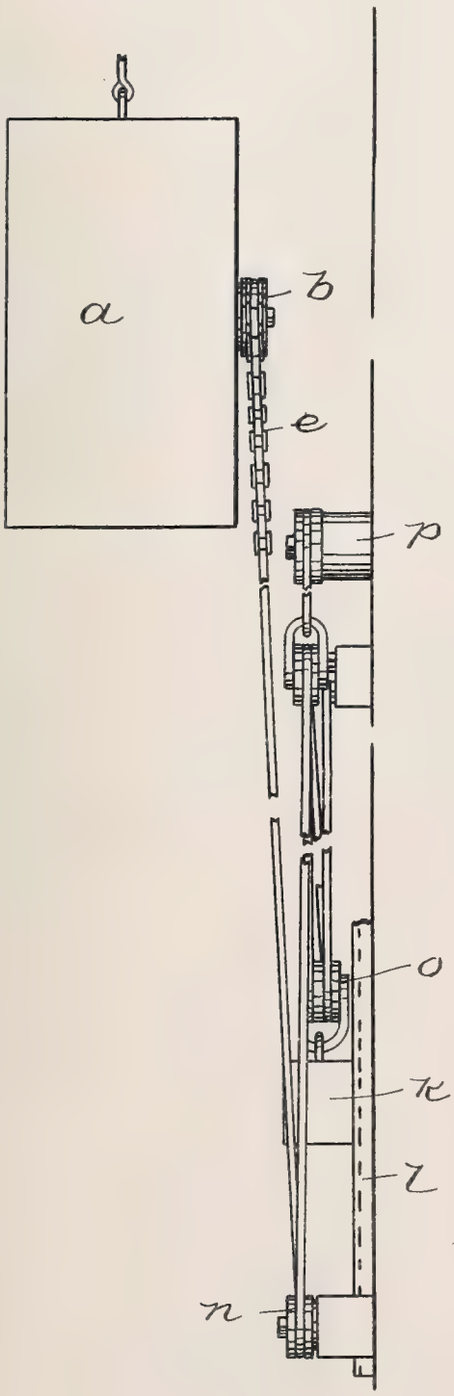

Fig. 8.

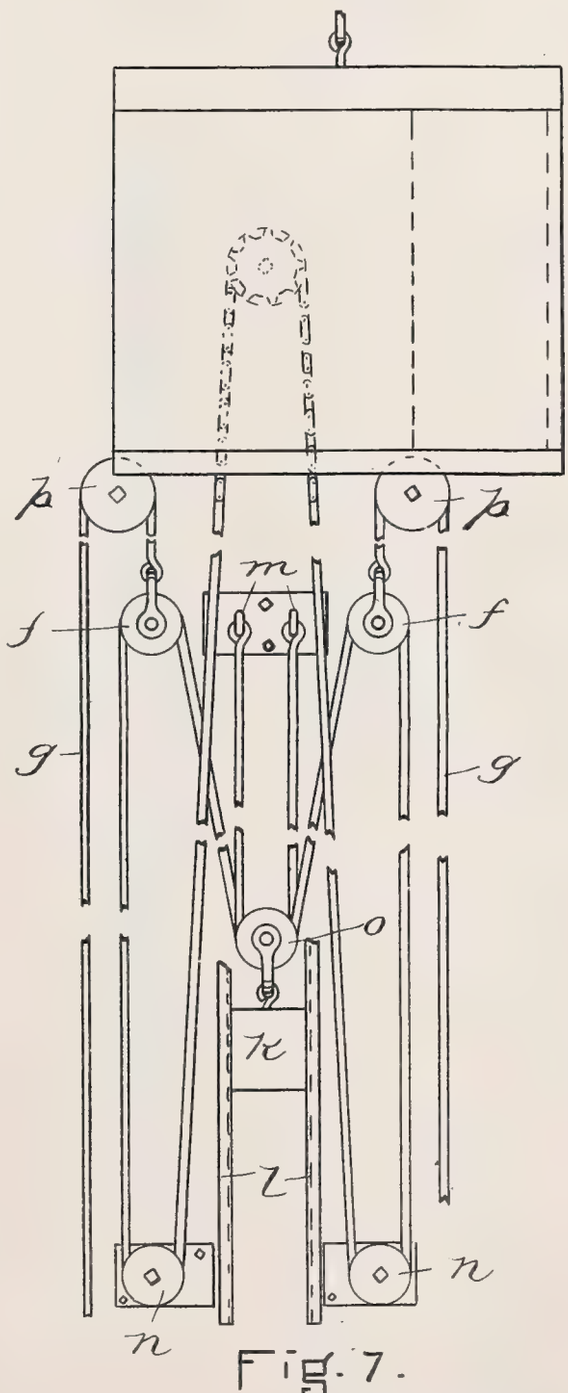

Fig. 7.

WITNESSES

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(No Model.) 12 Sheets—Sheet 5.

C. A. HARKNESS.

ELEVATOR.

No. 569,129. Patented Oct. 6, 1896.

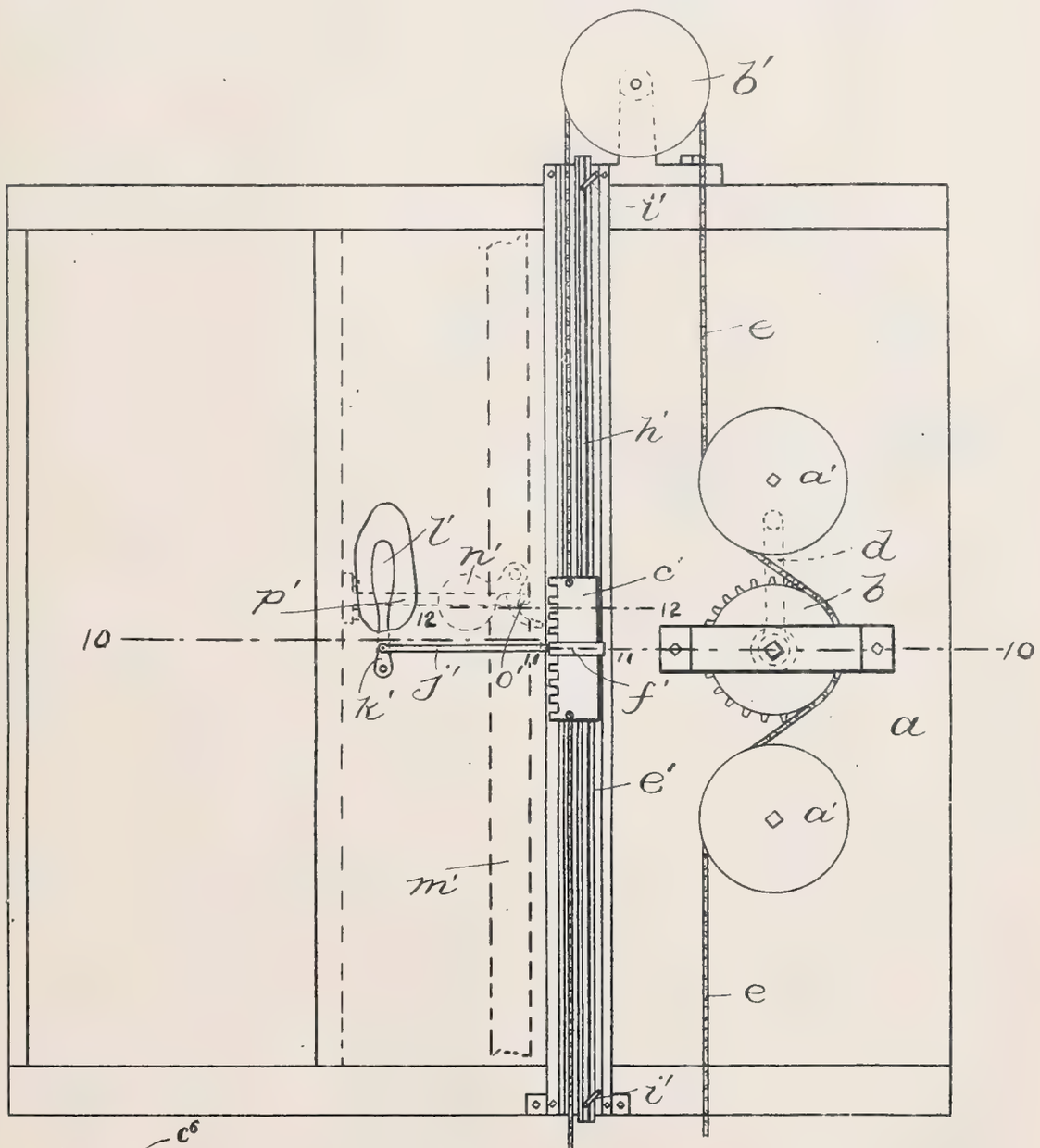

Fig. 9.

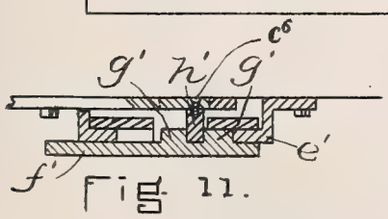

Fig. 11.

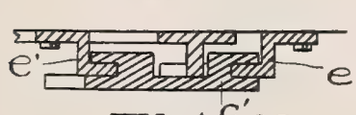

Fig. 12.

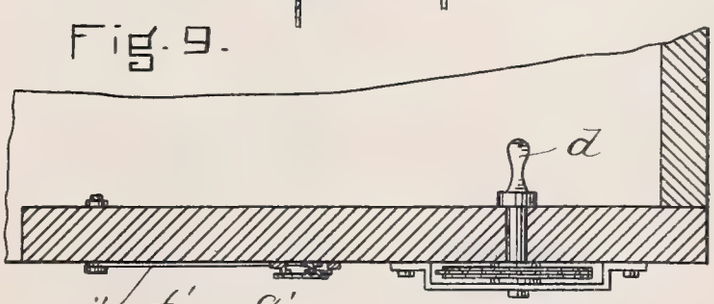

Fig. 10.

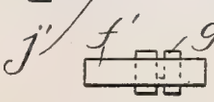

Fig. 13.

Fig. 14.

WITNESSES.

Matthew M. Blunt

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(No Model.) 12 Sheets—Sheet 6.

C. A. HARKNESS.

ELEVATOR.

No. 569,129. Patented Oct. 6, 1896.

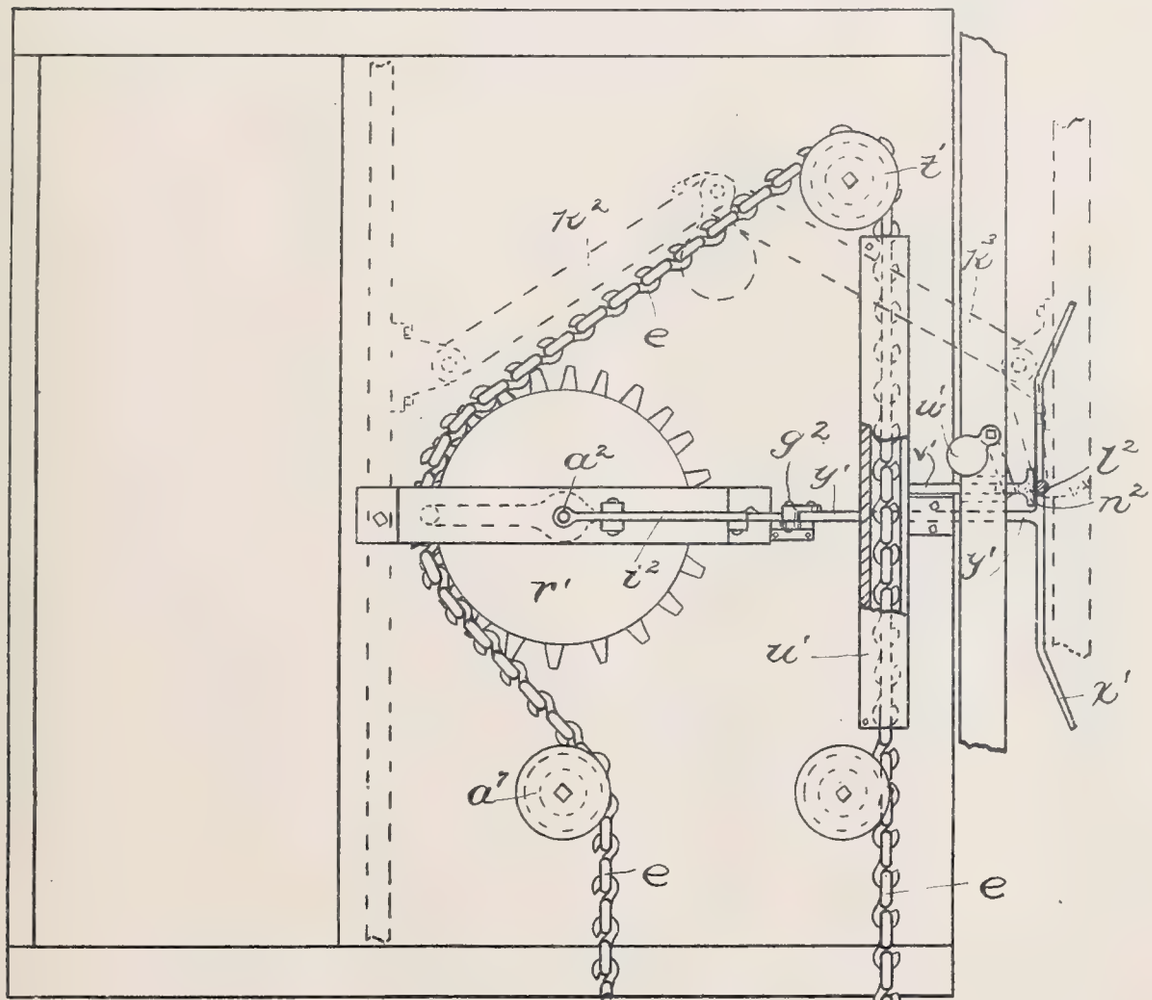

Fig. 10.

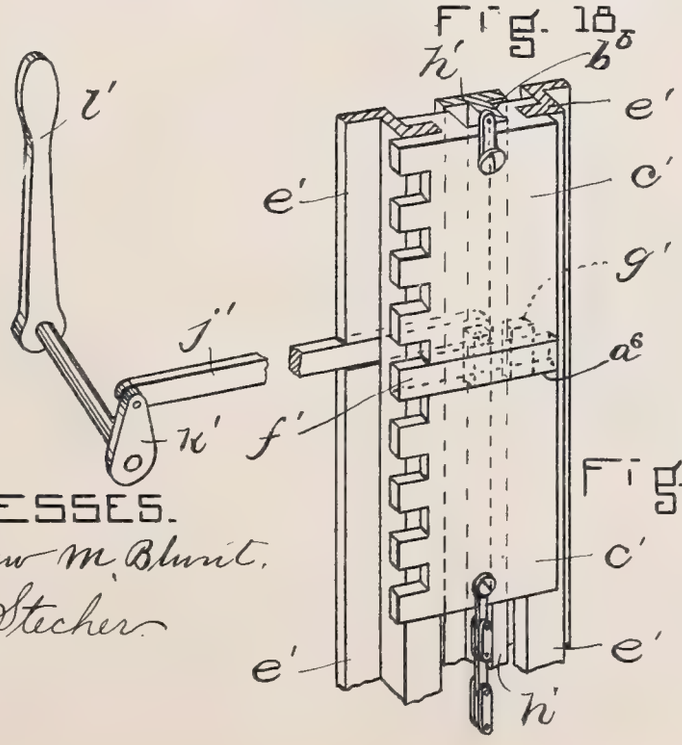

Fig. 10a.

WITNESSES.
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M. B. Mann
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(No Model.) 12 Sheets—Sheet 7.

C. A. HARKNESS.

ELEVATOR.

No. 569,129. Patented Oct. 6, 1896.

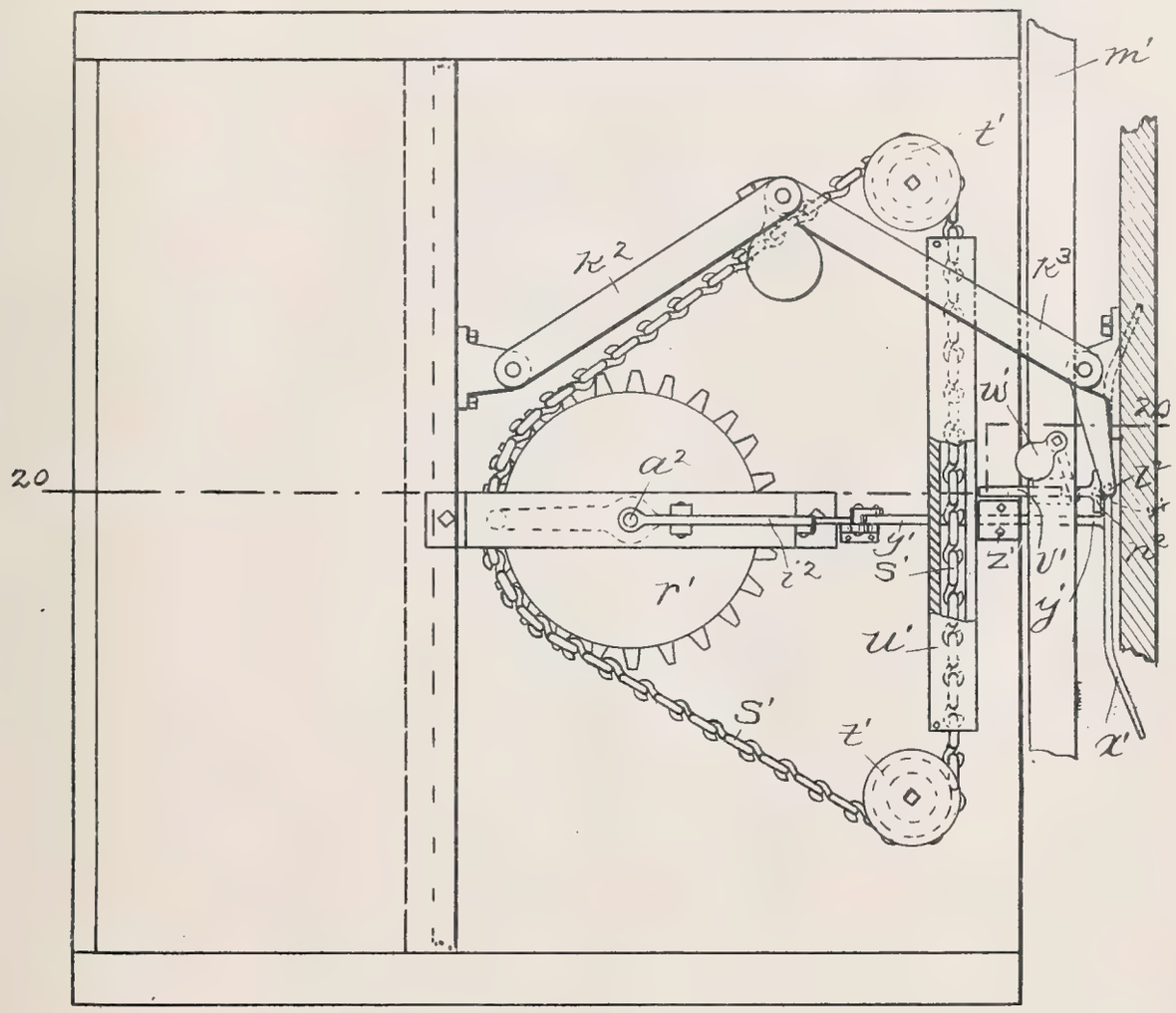

Fig. 15.

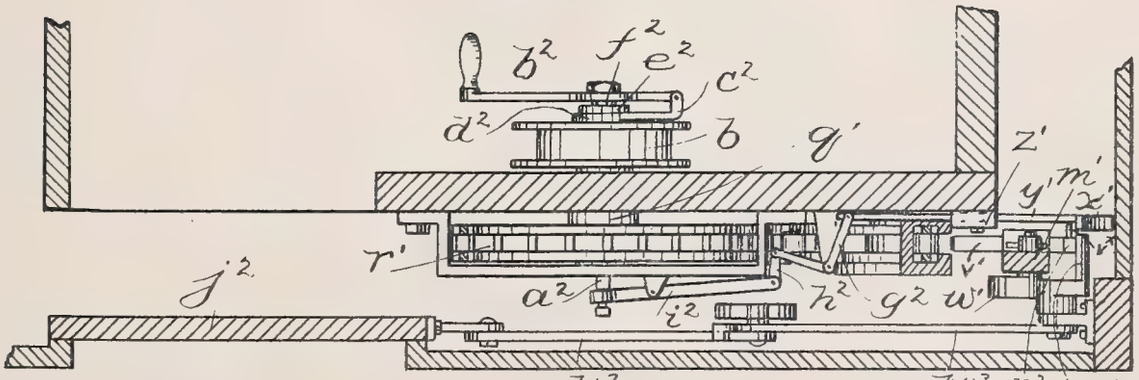

Fig. 16.

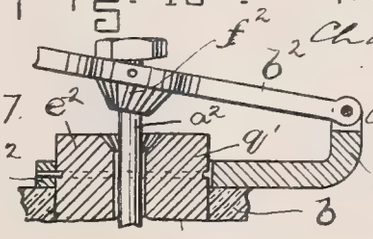

Fig. 17.

WITNESSES.

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C. A. HARKNESS.

ELEVATOR.

No. 569,129. Patented Oct. 6, 1896.

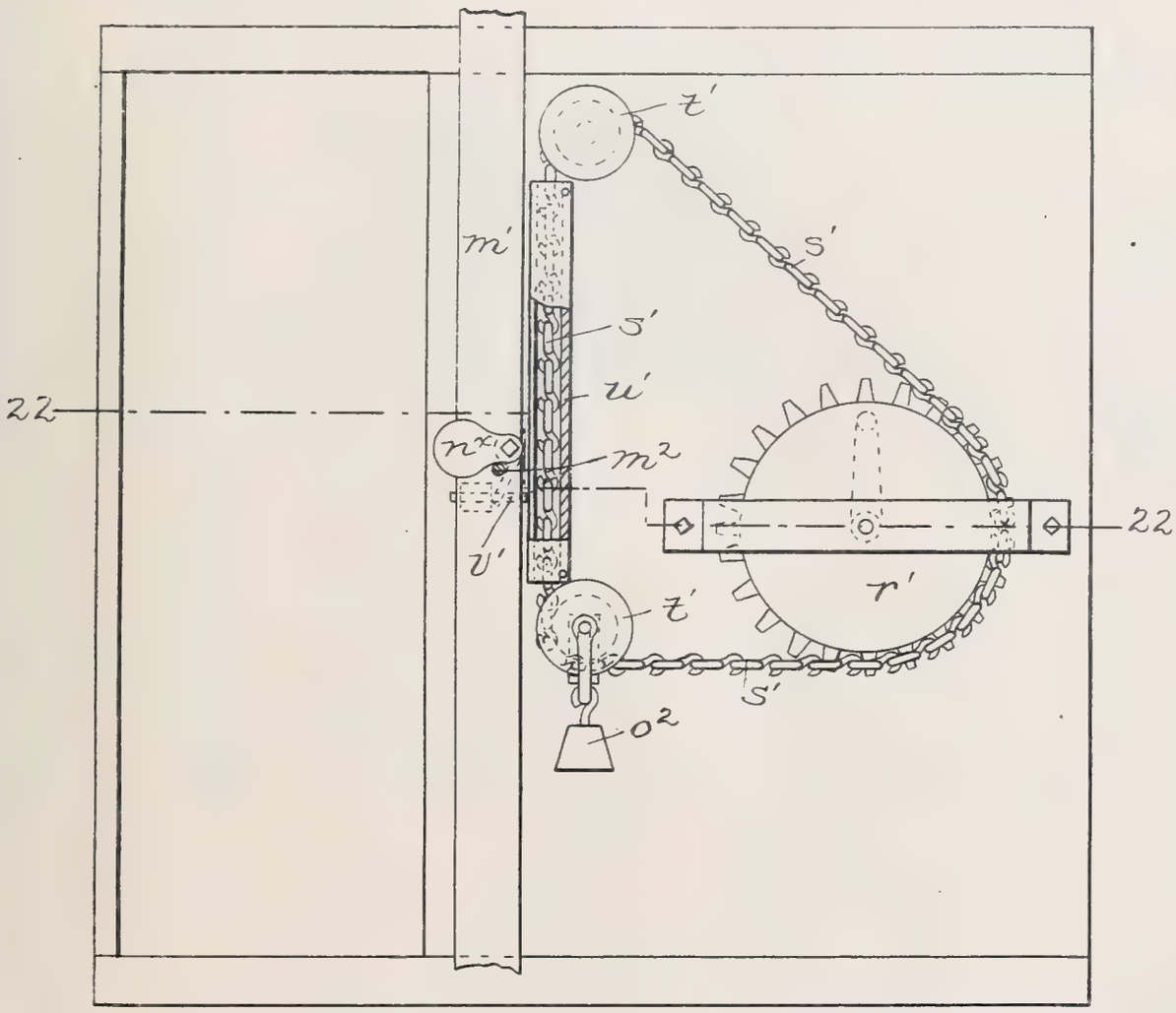

Fig. 19.

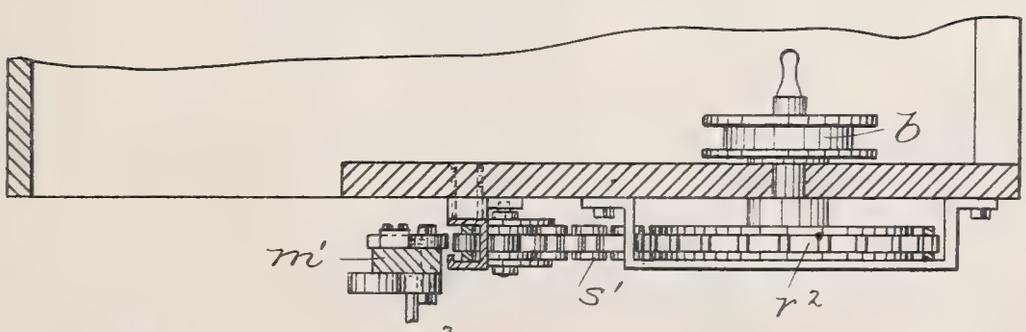

Fig. 20.

WITNESSES

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C. A. HARKNESS.

ELEVATOR.

No. 569,129. Patented Oct. 6, 1896.

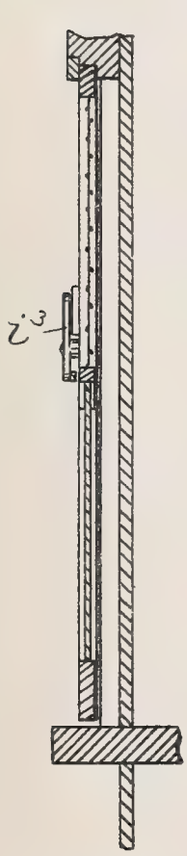

Fig. 22.

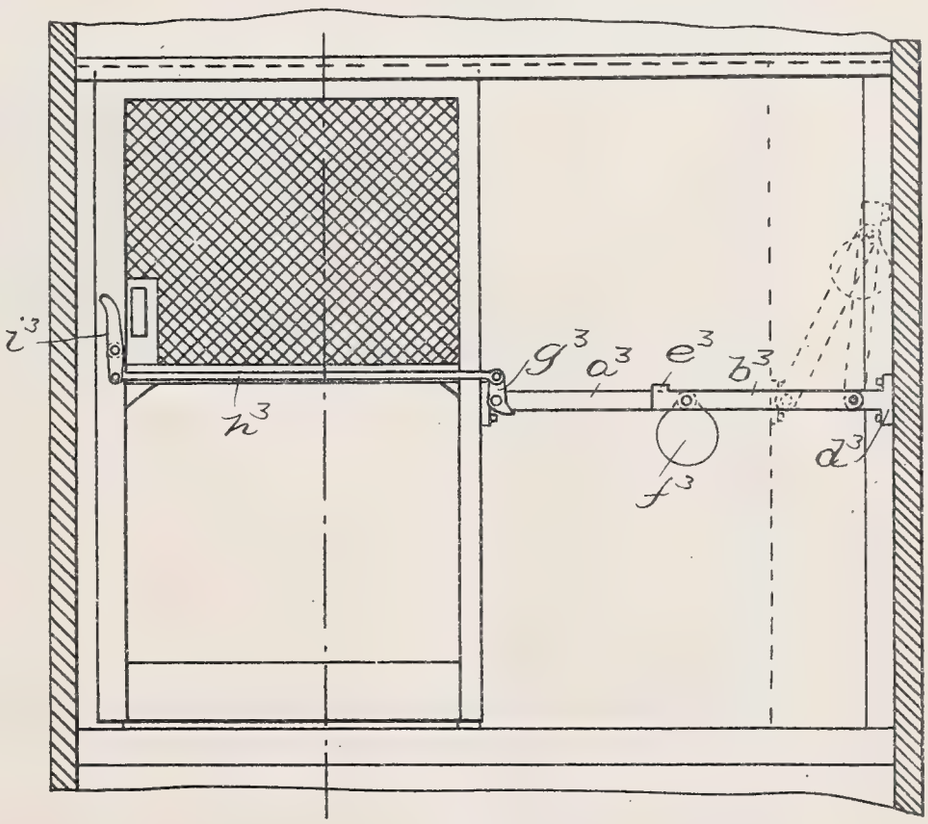

Fig. 21.

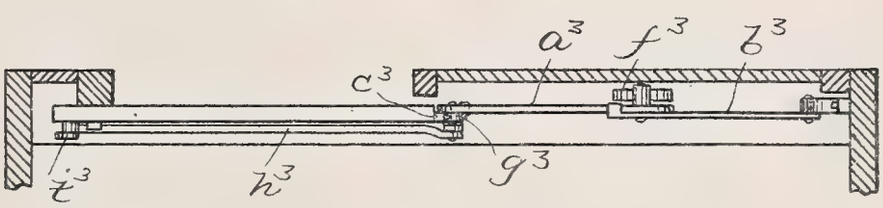

Fig. 23.

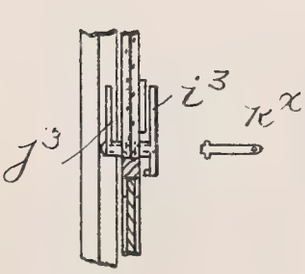

Fig. 24.

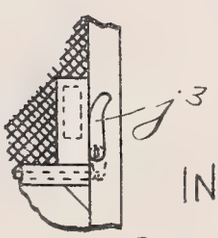

Fig. 25.

WITNESSES.

Matthew M Blunt

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C. A. HARKNESS.

ELEVATOR.

No. 569,129. Patented Oct. 6, 1896.

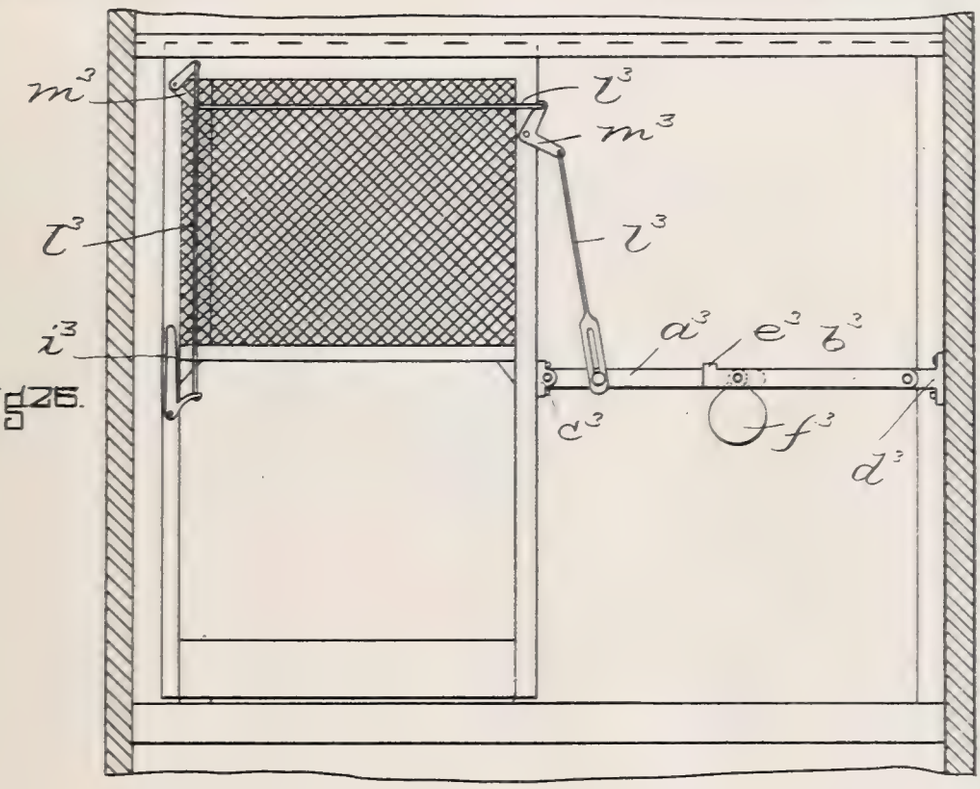

Fig 26.

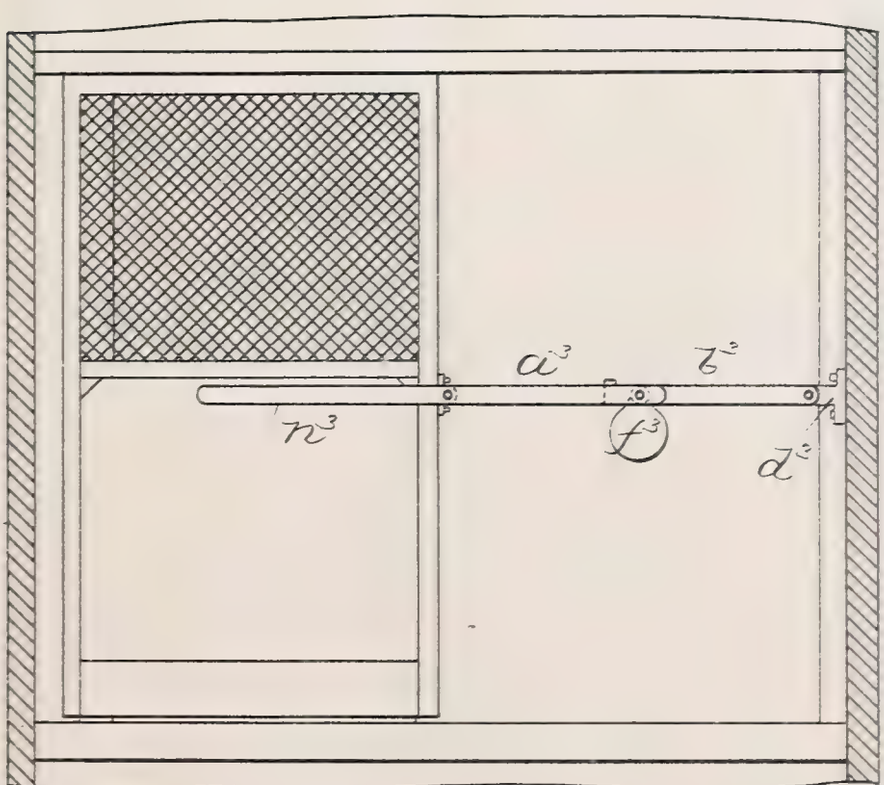

Fig 27.

WITNESSES.

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ATT'Y.

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C. A. HARKNESS.

ELEVATOR.

No. 569,129. Patented Oct. 6, 1896.

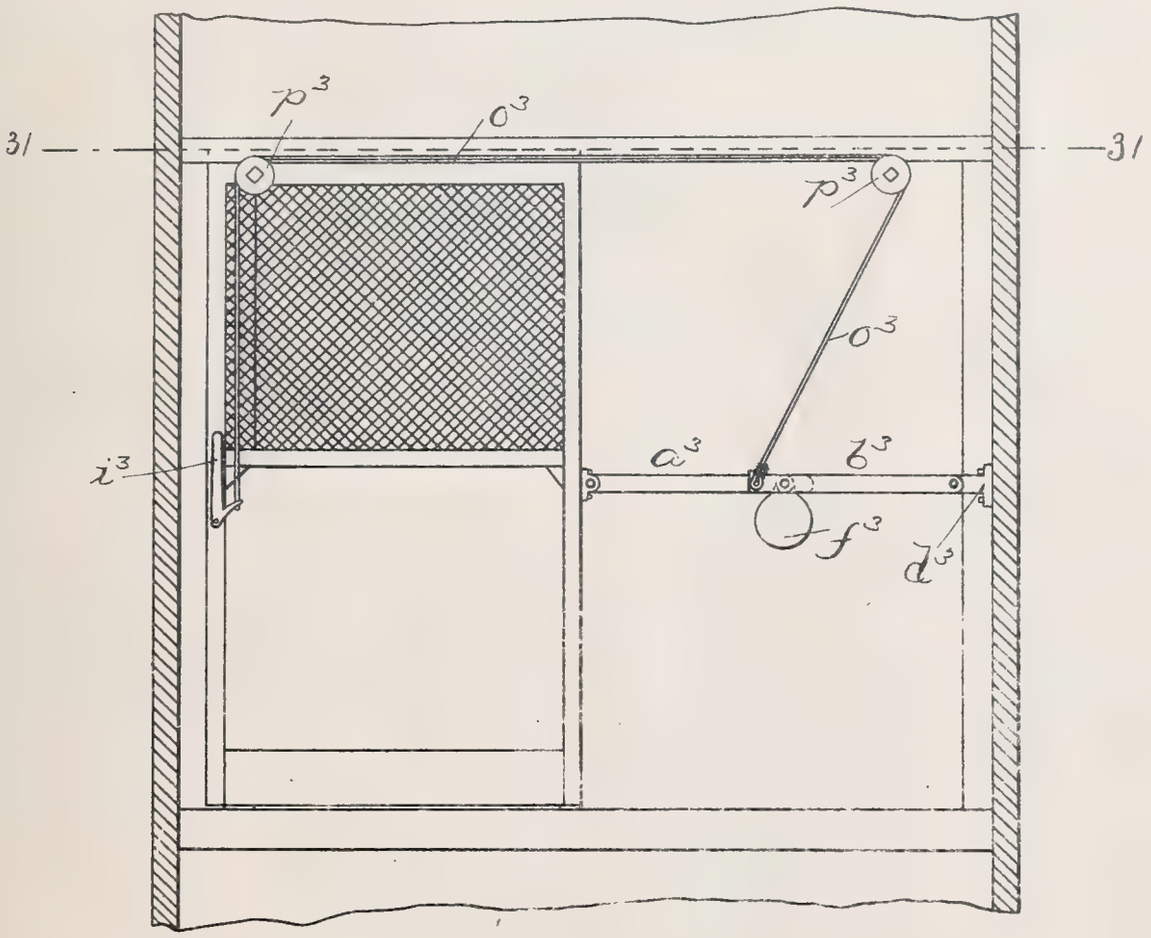

Fig. 28.

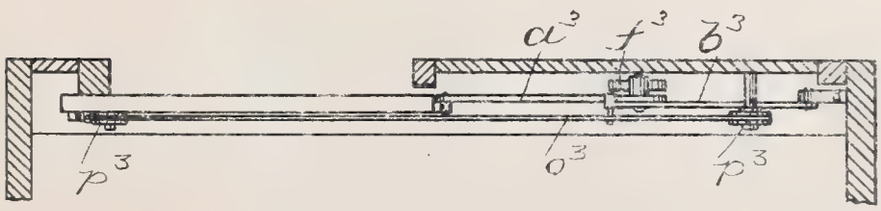

Fig. 29.

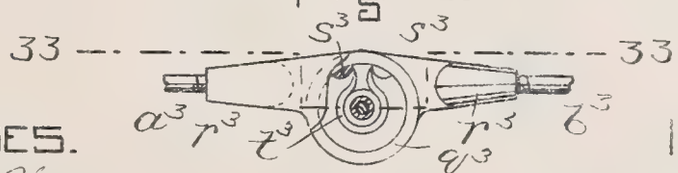

Fig. 30.

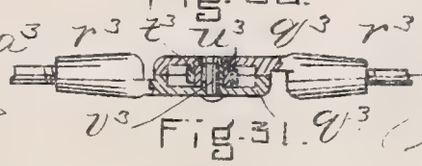

Fig. 31.

WITNESSES.

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C. A. HARKNESS.

ELEVATOR.

No. 569,129. Patented Oct. 6, 1896.

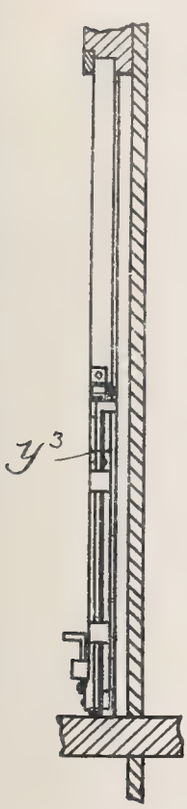

Fig. 33.

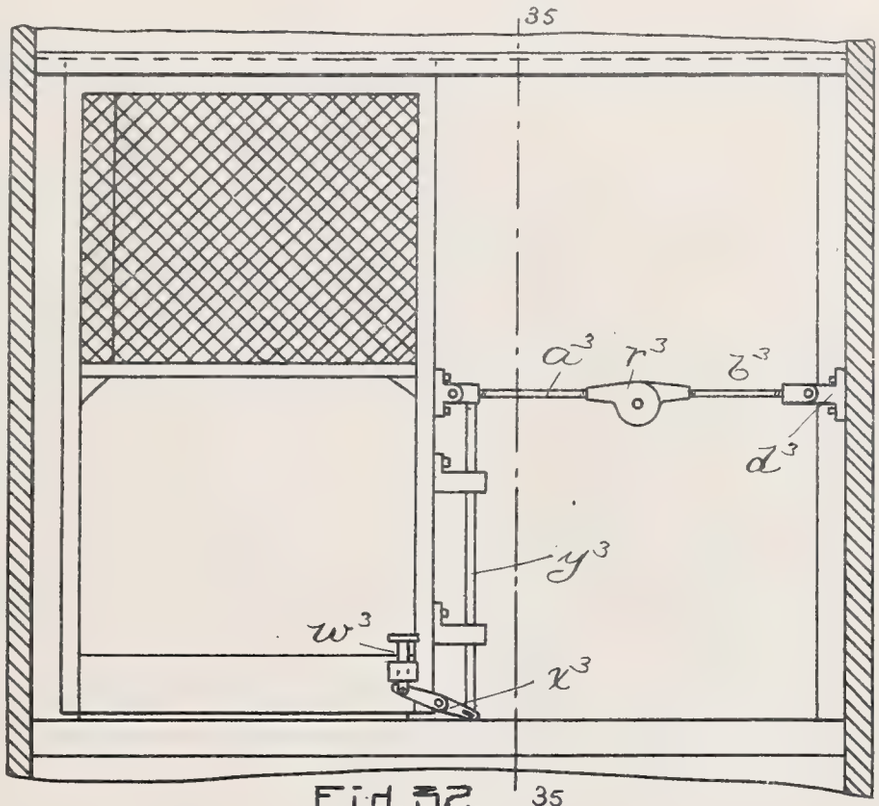

Fig. 32.

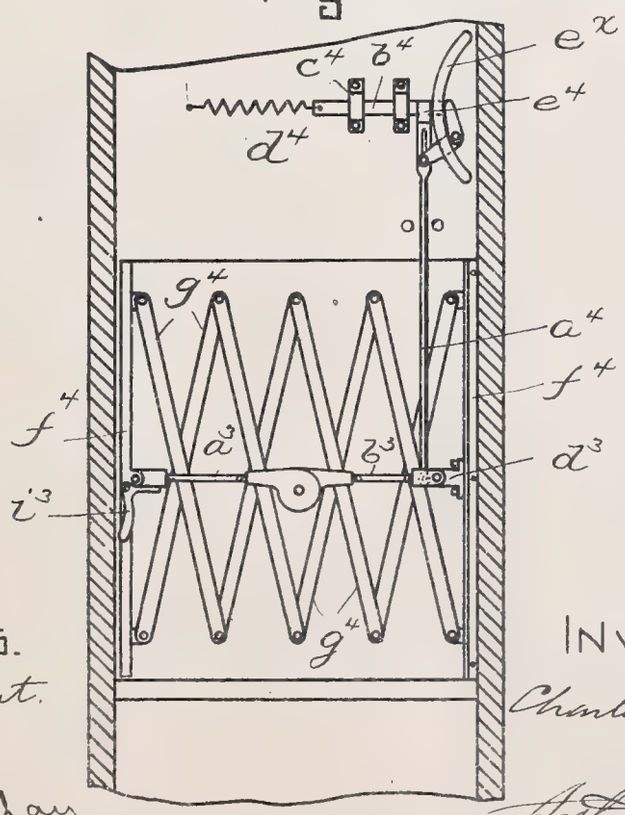

Fig. 34.

WITNESSES.

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Marcus B. May

INVENTOR.

Charles A. Harkness

By

Arthur W. Crossley

ATT'Y.

UNITED STATES PATENT OFFICE.

CHARLES A. HARKNESS, OF PROVIDENCE, RHODE ISLAND.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 569,129, dated October 6, 1896.

Application filed October 17, 1895. Serial No. 565,955. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. HARKNESS, of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Elevators, of which the following is a specification.

This invention has relation to elevators generally, and particularly to what are commonly called "passenger-elevators;" and it has for its objects, first, the provision of an improved method of equipping the elevator-car with a controlling rope or line with a view to keeping the line taut at all times and preventing shock to the same and to the car through sudden stopping or starting; second, the provision of improved means for securing the stoppage automatically of the car with certainty at the landings along the line of the elevator-shaft; third, of providing improved means for preventing the starting of the car after the same has been stopped and the corridor-door opened to any extent until the door is first fully closed; fourth, the provision of means for preventing what is commonly termed "creeping," that is, a slight movement of the car after it has been stopped; fifth, the provision of improved means for automatically shutting and for locking the doors, whereby the use of catches or projections, which are liable to tear or injure the clothing or person of a passenger, is obviated; sixth, the provision of an automatic secondary lock for the doors for absolutely locking the door against movement except when the car is at the landing.

To these ends the invention consists in the improvements which I will now proceed to describe in detail, and then point out with particularity in the appended claims.

Reference is to be had to the annexed drawings, and to the letters marked thereon, forming a part of this specification, the same letters designating the same parts and features, as the case may be, wherever they occur.

Of the drawings, Figure 1 is a front elevation of an elevator-car equipped with a controlling rope or line constructed and arranged in accordance with my improvements. Fig. 2 is a side elevation of what is illustrated in Fig. 1. Figs. 3 to 8, inclusive, illustrate modifications with respect to the manner of roping and applying the tension-carriage and the valve-actuating devices to the rope or line. Fig. 9 is a side elevation of a car provided with means for automatically stopping the car at a predetermined point and locking it at said point by means coacting with the corridor-door. Figs. 10 to 14, inclusive, illustrate details of construction of the various parts shown in Fig. 9, the sections in Figs. 10 and 12 being on the lines 10 10 and 12 12, respectively, of Fig. 9, and the section in Fig. 11 being also on line 10 10, Fig. 9, but somewhat enlarged. Figs. 15, 16, and 17 illustrate a slightly-modified construction, by means of which the car may be automatically stopped at a landing and the operating-line locked against movement by means coacting with the door. Fig. 18 illustrates the locking and stopping devices as directly engaging the valve-controlling line itself. Figs. 19 and 20 show a still further modified form for accomplishing the locking of the car against movement while the door is open, it being similar in a number of respects to the construction shown in Fig. 15. Figs. 21 to 23, inclusive, show an improved means for positively locking the corridor-door against movement from the outside by aid of weighted toggle-levers. Figs. 24 and 25 show devices for locking the outer handle of the door to the inner handle, whereby the door may be opened from the outside with the aid of a key. Figs. 26 to 33, inclusive, show door-closing devices, all more or less modified from that shown in Fig. 21. Fig. 34 illustrates a secondary lock for the door which is quite frequently employed in connection with the toggle-levers and which is adapted to be operated by the car or a device mounted thereon.

In the drawings, *a* designates an elevator-car provided with a line-shifting device, consisting, in this embodiment of my invention, of a pulley or sheave *b*, journaled on a shaft *c*, supported in suitable bearings in its wall or side and having a hand-operative device in the form of a crank or handle *d*, fixed on the inner end of the said shaft.

e designates the controlling rope or line which passes around the pulley *b*, down around pulleys *f f*, with which the lines *g g* are connected, thence up over pulleys *h h* and *i i* above the car, the ends being connected, as shown, with the wall of the well by bolts

m. A tension device, consisting in this instance of a weight *k*, and a bar *j*, from which it depends, is arranged on the line, so as to take up the slack, there being pulleys *o o* under which the line passes. The weight *k* travels in guides *l* on the wall of the well or hatchway, the guides being disposed out of the path of the car, since the weight travels in a direction opposite to that of the travel of the said car. The guides extend from the top of the well or hatchway to a point half-way of the travel of the car.

In Figs. 3 and 4 I have shown how the weight *k* may travel in guides *l l*, extending downward from the center of the well or hatchway, the other parts being the same as those illustrated in Figs. 1 and 2. By passing the operating-line directly from the pulleys *f* over pulleys *h*, which are located at the top of the guides near the center of the well or hatchway, I am enabled to use a much shorter line, as will be readily seen.

Instead of arranging the pulleys *f f* and *h h*, respectively, side by side, as shown in Fig. 3, they may be placed as illustrated in Figs. 5 and 6—that is to say, the pulleys *h* are disposed one on each side of the bolts *m*, to which the ends of the operating-lines are secured, the pulleys *f f* being correspondingly arranged on either side of the guides *l l*.

It frequently happens in placing an elevator apparatus in a building that it is desirable to locate the pulleys *f f*, which are connected with the valve-operating devices, at points above the central part of the elevator well or hatchway. Hence I have shown in Figs. 7 and 8, inclusive, how the operating-line may pass from the wheel *b* on the car, down under sheaves *n* at the bottom of the well, up over the pulleys *f*, down under the pulleys *o*, which are attached to the weight, and finally have its ends secured to bolts on the wall of the hatchway. In this case, however, the pulleys *f f* are secured upon the ends of long cables, chains, or ropes *g*, which are passed over pulleys or sheaves *p*, secured at or near the center of the well or hatchway.

As is well known to those skilled in the art, the controlling-lines used in elevator structures to control the movements of the car are liable to variation as to their length by constant use and by changes in the atmosphere, and, furthermore, such ropes or lines are quite liable to become broken up and abraded by reason of their passage around their pulleys, which are usually small. This becomes at once an element of danger and renders their operation more or less uncertain. To avoid this, I may construct the said line so as that it shall have the characteristics of a chain, as is shown in Figs. 1 and 2. When the said line is constructed as a chain, while it may lengthen to some extent, the tension-carriage with which the line is supported will take up all slack, and as there is no appreciable shrinkage in the line it does not become so tightened as to cause it to bind and be hard or difficult of operation.

In all of the devices which I have illustrated it will be observed that the ends of the controlling-line are positively secured to the wall of the well or hatchway, and that the tension devices travel in guides out of the path of the car. This is of essence in my invention, since I am enabled thereby to keep the controlling-line taut at all times and coincidently therewith employ shorter lines than when the line has its ends secured directly to the weight.

In connection with the devices already described I provide means for automatically shifting the controlling-line and stopping the car at a landing or other predetermined point, and also means coacting with the door of the corridor or the car for automatically locking the line to the wall of the well and preventing the car from moving or creeping while the door is partially or entirely open.

The stopping means consists of a device mounted on the wall of the well and constructed to engage the line, or mechanism connected therewith, and hold it so that the continued movement of the car will effect a shifting of the pulleys which are connected with the valve for the motor.

The controlling-line belongs to the class known as "running-lines," that is, lines which are connected with the car and travel therewith, (in contradistinction to "standing-lines" or those relatively to which the car travels.) Hence in order to positively lock the running controlling-line against movement it is necessary to lock it to some stationary support on the wall of the well or hatchway.

Referring more particularly to Figs. 9 to 14, inclusive, the controlling-line *e* is engaged with the sprocket-wheel *b*, which is connected with the hand-operative device *d*, passing by two idlers *a' a'* on the car over a pulley *b'*, and thence downward to the motor-actuating devices.

Secured to the line at a point substantially midway between the top and bottom of the car is a rack-plate *c'*, sliding in guides *e'* on the car. (See Figs. 11 and 12.) The plate is provided with integral teeth, as shown, and has on its rear face a wide longitudinal groove b^6 and on its front face a transverse groove a^6. In the last-mentioned groove there is a sliding tooth *f'*, which has tongues *g' g'* to hold it in the said plate. The said tooth is slotted vertically to receive the edge of a movable T-shaped bar *h'*, which extends into and has a limited lateral movement in the vertical slot b^6 in the plate *c'*. Thus it will be seen that the plate and the tooth can slide freely vertically relatively to the bar *h'*, while at the same time the lateral movement of the bar in the slot b^6 will cause a similar movement of the tooth in the plate *c'*. The bar *h'* is supported at its ends by links *i' i'* and is connected by a screw with the end of a rod *j'*, which is secured

to the end of a crank k', fastened on the axis of of the handle l'.

On a strip m', secured along the elevator-well, I mount a swinging weighted latch or dog n', which has an outwardly-projecting end which is so arranged that when the parts are in the positions shown in Fig. 9 the plate c' and the tooth f' will move freely past it; but when the attendant is desirous of stopping the car he throws the lever l' to one side and draws the tooth out until its end will strike upon the end of the latch n'. This locks the plate c', and with it the operating-line, to the walls of the well, so that the continued movement of the car will shift the valve-operating pulleys and stop the motor. Then, when the car has come to a state of rest, the lever l' and the bar h' are allowed to return to their original positions and the tooth f' will be withdrawn. Then I bring into play the door-controlled devices for locking the line positively to the wall when the door is moved to open position.

o' is a pin or projection connected with the door and bearing against the latch or dog n', so as to hold it out of the path of the plate c', for the weight tends to throw the end of the dog forward. In this case the pin or projection o' is on a rod p', connected with the door, so that at the moment the latter begins to slide toward open position the pin will be moved away from the dog and the end of the latter will immediately slip in between the teeth of the rack-plate c' and lock the line to the wall of the well or hatchway until the door is fully closed.

In many elevators there is a tendency of the car to creep even after it has been stopped, owing to leakage at the motor or other causes, and hence by locking the line to the wall of the well a movement of the car in either direction will tend to start the motor in the opposite direction and bring the car to a perfect standstill. There are many other ways in which this result, as set forth above, may be accomplished. For instance, I have illustrated in Figs. 15, 16, and 17 a modified mechanism by means of which the car may be stopped in its movement at a predetermined point and have the controlling-line locked to the wall of the well. In this case the operating-wheel b for the controlling-line is mounted on the inside of the car, it being supported upon a tubular shaft q', upon the outer projecting end of which is mounted a sprocket-wheel r'.

s' is a sprocket-chain with centrally-open links which passes around the wheel r' and around two idlers t' t', so as to have a vertical portion arranged in a vertical line near the edge of the car, the chain forming, as it were, a triangle with one of its sides vertical. The vertical part of the chain passes through a guide u', which is open at its side, as clearly shown in the last-mentioned figures. The wheels b and r' being rigidly mounted upon the same supporting-shaft, it follows that when the chain s' is shifted so as to turn the wheel r' the wheel b and the valve-controlling line will be both correspondingly shifted.

m' is a strip which extends along the elevator well or hatchway, and upon this strip I mount a dog or latch v' which, though normally out of the path of the guideway u' and the chain s', may be also thrown into engagement with the chain, so that the continued movement of the car will cause the chain s' to move relatively thereto and rotate the wheel r' so as to shift the valve-controlling line and bring the motor to a state of rest. The latch-bar v', which is provided with a laterally-projecting pin $v^{\times}$, is normally held in its outer position by means of weight w'. In order that the latch-bar may be thrown in so as to engage with the chain s', I mount a sliding bow or cross-head x' upon the car, it having outwardly-inclined end portions and a central straight portion, as clearly shown in Fig. 15. It is secured to the rod y', which is adapted to slide in a bracket z' on the car.

a^2 is a rod which projects through the tubular supporting-shaft q' and has its inner end secured to a handle b^2. This handle b^2 is hinged to a bracket c^2 on a loose sleeve d^2, which is adapted to turn freely on the tubular shaft. Between the tubular shaft and the handle I place means for disengaging them, consisting of a clutch, so that the wheel b may at times rotate freely relatively to the handle. The end e^2 of the tubular shaft is provided with internal conical bearing-surfaces, with which the friction cone f^2 on the handle may engage when pressed inward, or the shaft-end may have internal teeth or corrugations to receive teeth or corrugations on the cone.

When it is desired by the attendant to turn the wheel b, he presses the handle b^2 inward, so that the friction-cone f^2 will engage the end of the shaft, and then by turning the handle while it is still firmly held inward the wheel b will be rotated.

g^2 is a bell-lever connected with the rod y' and with a link h^2 pivoted to a lever i^2, connected at its end with the sliding rod a^2. By means of these rods and levers, when the handle b^2 is drawn by the attendant away from the wall of the car the bow x' will be drawn inward, as will be clearly understood. In stopping the car automatically at a landing it is necessary to draw the bow x' inward, and as the car travels downward or upward the bow will engage the pin $v^{\times}$ on the latch v' and thrust the latter into engagement with one of the links of the chain s'. The continued movement of the car will shift the chain and the operating-line, as I have before described.

Of course it will be understood that, if desired, the car may be brought to a state of rest opposite a landing by turning the handle b^2 in the direction opposite to which it was turned to start the car.

There are several important results to be attained from the use of this form of mechanism, as, for instance, the handle is disengaged from the wheel b, a friction device or clutch being between them, so that when the bow has been drawn inward toward the car to effect a stopping at the next landing the handle has been drawn away so as to disengage it from the tubular shaft and the wheel b, allowing the latter to revolve freely while the handle remains stationary.

Although the devices just described are employed for stopping the car, yet they may be used to prevent creeping of the same when the door of the corridor is closed. It happens sometimes, unless a device of this kind be used, that after the attendant leaves a car with the door shut the car will creep in either direction, and hence by throwing the latch by means of the handle into engagement with the line and leaving it there the attendant may safely leave the car without danger of the latter creeping in either direction.

The latch or dog v' may be employed in connection with movable door-actuated devices for locking the line to the wall of the well to prevent creeping. The corridor-door j^2 is indicated as being connected with the side wall of the elevator-well by toggle-levers $k^2\,k^3$, the latter, k^3, being provided with a crank-pin l^2. When the door is moved toward open position, the crank-pin will impinge against the cross-head n^2 on the latch v' and push the latter in, so as to engage with one of the links of the chain s', thus locking the operating-line, through the medium of the chain s' on the sprocket-wheel r', to the wall of the elevator-well.

The latch v' in Fig. 18 and the latch v' and the chain s' in Fig. 15 constitute what I may term a "secondary" mechanism for stopping the car. That is to say, the mechanism is secondary to the line-shifting wheel, and the handle b^2 may be connected with either the line-shifting wheel or pulley and the secondary mechanism by means of the clutch before described.

In Fig. 18 I have illustrated how the latch may be operated to engage the links of the controlling-line instead of engaging those of a supplemental line. The controlling-line passes around the sprocket-wheel r' outside of the car, up over idler t', through the guide u', and from thence to the motor-actuating pulleys. (Not shown in this figure.) An additional idler a^7 is employed to insure that the chain will be properly guided to the sprocket-wheel. The mechanism for engaging the latch with the chain is similar to that just described.

In Figs. 19 and 20 I show substantially the same construction, except that the means for stopping the car in its movement is omitted. In this construction the latch v' is mounted upon the strip m' and is held out of the path of the guide u'.

n' is a weighted lever pivoted on strip m', which tends to throw the latch v' forward, the weight being held up by a pin m^2 on the door, (the latter not being shown.) This pin is so arranged on the door relatively to the weight that when the door is closed the weight will be held in the position shown in Fig. 19, but as soon as the door is partially open the pin will be moved from under the weight and the latter will cause the lever $n^\times$ to force the dog or latch v' into one of the centrally-open links of the chain s'. I prefer to mount one of the idler-wheels t' so that its supporting-axle may slide in a guide on the car, and I attach the weight o^2 to the axle, so that the wheel will act as a tightener for the chain to keep it taut.

The stopping means, Figs. 9 to 18, inclusive, operates to stop the car at an exact point without any calculating on the part of the attendant, as he has merely to throw the lever outward, as in Fig. 9, or draw it inward, as in Figs. 15, 16, and 17. The line is positively engaged by the latch or dog, so that there is no chance for any slipping, as the latch either engages a link in the chain or else a rack-plate mounted on the line, which, however, is shown also as being a chain. In this construction which I have just described the latch or dog (n' in Fig. 9 and v' in the other figures) also constitutes means in the hatchway for engaging the line to prevent creeping, and coacts with the door to lock the line when the door is partially or entirely open, since the door is provided with means (as pin o' and arm p', Fig. 9, or crank-pin l^2 and toggle-levers $k^2\,k^3$, in Fig. 15) coacting with the latch only when the door is open, since at all other times the latch is held from engagement with the line. The line is hereinafter referred to as being provided with stops, and it will be understood that I do not limit myself to the use of a line having a portion formed as a chain, a rack-bar connected with the line, or a chain connected to the line through the medium of a gear-wheel, as the line may be provided with balls or attachments, which I have not illustrated, since they are common in the art. The line provided with stops is connected with the line-shifting means or pulley b and travels with the car, so that the engagement of the latch therewith prevents creeping.

When I refer to the "means mounted on the car independently of the shifting means for connecting the line and the latch" I mean that the tooth f' in Fig. 9, and the cross-head x' and chain s' in Fig. 15, and the cross-head x' in Fig. 18 are not supported upon the line-shifting pulley b, but are mounted independently thereof on the wall of the car, although the said tooth in Fig. 9 and the said chain and cross-head in Figs. 15 and 16 and said cross-head in Fig. 18 are all indirectly connected therewith. In all these cases the engagement of the latch with the tooth or the chain, the chain e being a part of the line itself in Fig. 18, shifts the line to stop the

travel of the car, the positive engagement being caused by a hand device consisting of lever l', crank k', and link j' in the embodiment of the invention illustrated in Fig. 9, and handle b^2, rod a^2, lever i^2, link h^2, and bell-crank lever g^2 for operating the crosshead x' in those forms illustrated in Figs. 15, 16, and 18.

In Figs. 21 to 33, inclusive, I have illustrated several forms of mechanism for automatically closing and locking the corridor-door so as to prevent any one from incautiously leaving the door open or unlatched and thereby causing an accident. It is always necessary in a building to have one of the corridor-doors (usually the one in the basement) provided with means whereby it may be operated from the outside, so that the attendant may have ingress to the elevator-car, and also necessary to have the other corridor-doors provided with locks that can be operated only from the inside, and in order to prevent a door from being left unlatched by a careless attendant it is desirable that means may be provided for causing the door to close automatically after it is started by the attendant.

I provide toggle-levers a^3 b^3, pivoted together, the lever a^3 having its forward end pivoted to a bracket c^3 at the rear edge of the door and the lever b^3 having its rear edge pivoted to a bracket d^3, secured to the wall. The levers are of such length that when the door is closed they are on a "dead-center," one of the levers b^3 being provided with a stop e^3, adapted to project laterally and lie upon the top of lever a^3 to hold them in this position.

f^3 is a weight depending from the pivot connection of the two levers and of a size sufficient to slide the door forward when the levers are moved, so as to form an angle or an inverted **V**. The bracket is extended a short distance out beyond the wall, so that when the door is moved to its extreme open position the pivot connecting the levers lies on the opposite side of the pivot in the bracket d^3, so as to support the weight in its raised position. A slight forward movement of the door, however, will throw the weight past the pivot and the door will automatically shut. When the door has been shut, the levers will positively lock the door against opening.

In order to provide means for throwing the levers out of their dead-center position, several devices may be employed.

In Fig. 21 I have shown how a lever g^3, with a laterally-projecting end lying under the lever a^3, may be pivoted on the bracket c^3 and connected by a link h^3 with a handle i^3, pivoted at the front of the door. When the handle is pulled backward by the attendant, the lever g^3 is tilted, lifting the lever a^3 so as to throw the central pivot out of alinement with the two other pivots, whereby the door may be easily slid to open position, where it will remain until it is drawn slightly toward its closed position.

In Figs. 24 and 25 I have shown the handles employed on the corridor-door in the basement. The other doors are not provided with outside handles, as it is desired that they should be opened only from the inside. It is desired to provide the corridor-door of the basement with an outer handle, which may be connected with the inner handle by a key. The outer handle j^3 is mounted loosely relatively to the inner handle i^3, each being provided with a keyhole-slot, through which a key k^4 may be thrust to connect the handles together. When the key is in place, the turning of the handle j^3 will throw the handle i^3 to one side and lift the levers from their locked position, so that the door may be opened. It will be understood that the keyhole-slots may be formed in such way as to require a particular key which is in the possession of the janitor or attendant.

In Fig. 26 the handle i^3 is connected with the lever a^3 by means of links l^3 and levers m^3, while in Fig. 27 the lever a^3 is extended to form a handle n^3, which may be grasped by the attendant and thrust down to open the door. The lever b^3 may be connected with the handle, if desired, as illustrated in Figs. 28 and 29, the connecting means in this case consisting of a chain, a cord, rope, or wire o^3, passing over idler-pulleys p^3.

In Figs. 30 to 33, inclusive, I have shown the levers a^3 b^3 as being round rods connected together by heavy castings which themselves form the weight to move the door. The metallic castings are duplicates, each being formed with a cup-shaped disk q^3 and an internally-threaded socket r^3 to receive the end of its rod a^3 or b^3. The disks are cast with stops or lugs s^3 s^3, between which a heavy curved spring t^3 is inserted to prevent the stops from striking together when the door is closed and to cushion them. One of the disks is cast with a reduced internal annular ring u^3, through which a pivot-bolt v^3 passes to pivot the castings together. Thus it will be seen that the door is provided with a cushioning spring, and that the rods are provided with weighted means at their pivotal connection without adding a separate independent weight. The means for throwing the rods out of a dead-center consists, in Fig. 32, of a foot-actuated pin w^3, a lever x^3, connected therewith, and a rod or bar y^3, having its upper end under the rod a^3. When the pin w^3 is depressed by the foot, the rod y^3 is raised, lifting up the rod a^3, as will be clearly understood.

In all these devices it will be understood that I have provided means for positively locking the door shut without the aid of any projecting catches or hooks, which are always in the way of passengers entering or leaving the car, and which frequently tear the clothing or injure the person. It is impossible to tamper with a lock of this character or to leave the door partially open.

In order to prevent the door from being

opened except when the car is opposite it, I provide a secondary lock, one form of which is shown in Fig. 34. The form illustrated in the last-mentioned figure consists of a vertical rod a^4, pivoted to the lever b^3, and a horizontally-sliding bar b^4, supported in guides c^4 and normally held by a retractile spring d^4, so that a lateral projection e^4 on said bar b^4 will lie just above the end of the said rod a^4. The bar b^4 is provided at its outer end with a curved cross head or bow $e^\times$, with which a projection (not shown) on the car may engage and draw the bar forward, so as to remove the projection e^4 from above the rod, so that the latter is free to rise when the levers a^3 b^3 are actuated. In order to insure that the end of the rod a^4 shall escape the projection on the bar b^4 when the cross-head is moved forward by the projection on the car, I connect the slotted upper end of the said rod a^4 with one arm of a bell-lever r^5, the other arm of which rests against the end of the bar b^4, so that when the said bar is moved forward the bell-lever will throw the upper end of the bar a^4 to one side, so that as it rises it will escape the lateral projection e^4 on the bar b^4. In this way I provide not only a lock for preventing mischievously-inclined or forgetful persons from opening the door or leaving it open, but provide, in addition thereto, means for positively preventing the door from being opened except when the car is opposite it.

The locking-levers may be employed in connection with the extensible doors sometimes employed in elevators, as shown in said Fig. 34, in which two vertical side bars f^4 f^4 are connected by lazy tongs g^4 g^4, so that the said bars may be moved toward each other to open the passage-way, or from each other to close it. The weighted toggle-levers are pivoted to the side bars f^4 f^4 so as to hold them in a separated position, and the secondary lock, as shown in Fig. 34, is employed to prevent the levers from being operated except when the car is opposite the door, as the said secondary lock is mounted in such way as to be inaccessible to mischievous or evil-minded persons.

Having thus explained the nature of the invention and described ways of constructing and using the same, though without attempting to set forth all of the forms in which it may be made or all of the modes of its use, it is declared that what is claimed is—

1. In an elevator, a car, a pulley thereon, a hand device for said pulley, two actuating-pulleys connected with the motor, guides on the wall of the hatchway out of the path of the car, a tension device traveling in said guides and having a pulley, and a controlling-line having its ends secured directly to the wall of the hatchway, and passing under the pulley of the tension device, around the said actuating-pulleys, and around the said pulley on the car.

2. In an elevator, a car, a hand device on the car for the controlling-line, two actuating-pulleys connected with the motor, stationary guides out of the path of the car, a tension device traveling in said guides and having a pulley, an idler-pulley on the walls of the hatchway, and a controlling-line having its ends secured directly to the wall of the hatchway and passing under the pulley on the tension device, around the idler-pulley on the wall of the hatchway, from thence around the actuating-pulleys, and finally connected to the hand device on the car.

3. An elevator apparatus, comprising a car, a line traveling with the car, a hand device on the car for shifting said line, a movable door, and means coacting with the door for locking the line when the door is partially or entirely open.

4. In an elevator, a movable door, a controlling-line connected to and traveling with the car, and means coacting with the door to lock said line against movement relatively to the hatchway while the door is partially or entirely open, whereby creeping of the car is prevented.

5. In an elevator, a car, an operative line traveling with the car, and means in the hatchway for locking said line to the hatchway to prevent creeping of the car.

6. In an elevator, a car, an operative line traveling with the car, a movable door, a latch for said line mounted in the hatchway, and means mounted on said door and coacting with said latch whereby the latch locks the line to the hatchway when the door is partially or entirely open.

7. An elevator-controlling device, comprising a line traveling with the car, a movable latch mounted in the hatchway, a movable door, and means coacting with the door whereby the latch is engaged with the line only when the door is open.

8. An elevator-controlling device, comprising a line traveling with the car and provided with stops, a movable latch mounted in the hatchway, a door, and means coacting with the door for holding the latch out of engagement with the line except when the door is open.

9. An elevator-controlling device, comprising shifting means on the car, a chain connected therewith and traveling with the car, a movable latch in the hatchway, and a door, coacting with said latch whereby the latch is moved into engagement with the chain when the door is open.

10. An elevator-controlling device comprising an operative line traveling with the car, a supplemental chain mounted on the car and connected with the line-shifting means, a movable latch in the hatchway, and a door coacting with said latch whereby the latter is engaged with the links of the supplemental chain only when the door is open.

11. An elevator-controlling device, comprising a line traveling with the car for controlling the motor, means on the car for shifting

the said line, a movable latch in the hatchway, and means mounted on the car independently of the said shifting means for connecting the line and the latch to stop the car.

12. An elevator-controlling device comprising a line traveling with the car for controlling the motor, means on the car for shifting the line, a movable latch in the hatchway, means with which the latch may engage, said means being operatively connected with the line and mounted on the car independently of the said shifting means, and a hand device for causing said latch to engage the last said means and thereby stop the travel of the car.

13. An elevator-controlling device comprising line-shifting means on the car, a line traveling with the car and provided with one or more stops, said line being connected with the said line-shifting means, a latch on the wall of the hatchway and means on the car for causing a positive engagement between said latch and the said line provided with stops as aforesaid, to stop the travel of the car.

14. An elevator-controlling device comprising line-shifting means on the car, a line traveling with the car provided with one or more stops, and connected with the line-shifting means, a latch on the wall of the hatchway, and hand-operative means on the car for causing a positive engagement between the said latch and the said line, to stop the travel of the car.

15. An elevator-controlling device, comprising shifting means on the car, a chain connected therewith and traveling with the car, a movable latch in the hatchway, and hand-operative means on the car for moving said latch into engagement with the said chain.

16. An elevator-controlling device comprising shifting means on the car, a chain traveling with the car and connected with the shifting means, a movable latch mounted in the hatchway, and a hand-operative means, having as a part thereof a bow or cross-head for moving the latch into engagement with the chain.

17. An elevator-controlling device, comprising an operative line, means on the car for shifting the line to operate the car, secondary mechanism for stopping the car, and a single handle adapted to be connected to both said line-shifting means and said secondary mechanism whereby either may be operated thereby.

18. An elevator-controlling device, comprising a controlling-line, a wheel or pulley on the car for shifting the line, a secondary mechanism for stopping the car, and a handle arranged to operate either the wheel or pulley or the stopping mechanism alternately, and in such way that when one is being operated the other is disengaged therefrom.

19. An elevator-controlling device, comprising an operative line, a latch for engaging the line, a wheel on the car for operating the line, a handle for the wheel and means for disengaging the handle and the wheel when the latch engages the line.

20. An elevator-controlling device, comprising an operative line, a latch in the hatchway for engaging said line, a wheel on the car for the operative line, a handle, and a clutch interposed between the handle and the wheel, whereby when the wheel is turned during the travel of the car by the engagement of the latch with the line, the handle is not turned but remains stationary.

21. An elevator-controlling apparatus, comprising an operative line, a latch, a wheel on the car for operating said line, means on the car for causing the latch to engage the line, and a handle connected to the said wheel and to the said means, for operating both of them.

22. An elevator-controlling device, comprising an operative line, a latch for engaging said line, a wheel on the car for operating the line, means on the car for causing the latch to engage the line, a handle connected with the said means, and a clutch interposed between the handle and the wheel.

23. As a means for locking the controlling-line of an elevator, a movable door having an arm secured thereto, and a pivoted weighted latch directly engaged by the arm on the door, whereby it is held out of its locking position, and being adapted to swing to its locking position when the door is partially or entirely open.

24. As a means for locking the controlling-line of an elevator, a movable door provided with an arm which moves therewith, a weighted latch pivoted to normally swing into its locking position, but engaged by the arm of the door and held out of its locking position by the said arm when the door is closed, said arm moving as aforesaid with the door, whereby the latch swings into its locking position when the door is partly or entirely open.

25. An elevator-controlling device comprising an operative line, a latch for engaging said line, a wheel on the car for operating the line, a tubular shaft for said wheel, means on the car for causing the latch to engage the line, a rod passing through the tubular shaft for operating said means, a handle pivoted to a collar loose on the shaft, and having the said rod secured thereto, and a clutch interposed between the handle and the tubular shaft.

26. A lock for a door, consisting of toggle-levers pivoted to the door and to a stationary support and arranged to have their pivots in a straight line when the door is closed, and a stop carried by one of the levers for engaging the other lever for the purpose set forth.

27. A lock for a door, consisting of two pivoted levers, one having its outer end pivoted to the rear edge of the door, and the other having its outer end pivoted to the wall in the rear of the door, whereby said levers are out of the way behind the door when the latter is

opened, and a stop carried by one lever for engaging the other lever to hold them with their pivots in a straight line.

28. A lock for a door, consisting of toggle-levers pivoted to the door and to a stationary support, and arranged to have their pivots in a straight line when the door is closed, a handle pivoted on the door, a lever for moving the toggle-levers so that the door may be opened, and a link connecting the handle on the door and the said lever.

29. A lock for a door, consisting of toggle-levers pivoted to the door and to a stationary support, and arranged to have their pivots in a straight line when the door is closed, a handle pivoted on the door, a lever arranged to have a portion under one of the toggle-levers to lift it, and a link connecting the handle and the said lever.

30. The combination with the door and the toggle-levers pivoted together, of stops on the adjacent ends of said levers, and a spring interposed between said stops.

31. The combination with a movable door, and two toggle-levers for locking said door, and pivoted to the door and to a stationary support, a vertically-movable bar connected with one of said levers, and a lock for said bar adapted to be moved out of the path of the said bar by the car, so as to allow the door to be opened.

32. The combination with a door, and a lock for said door, of a mechanism for locking the said lock from being actuated, and having a portion extending out into the path of the car, whereby it may be positively engaged by said car, and mechanically disengaged by the car from the said lock.

33. The combination with a door, and a lock for said door, of mechanism for locking the said lock from being actuated, said mechanism having as a part thereof a cross-head mechanically connected to said lock mechanism adapted to be directly and positively engaged by the car, for mechanically disengaging the mechanism from the lock.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 20th day of November, A. D. 1894.

CHARLES A. HARKNESS.

Witnesses:
ARTHUR W. CROSSLEY,
MARCUS B. MAY.

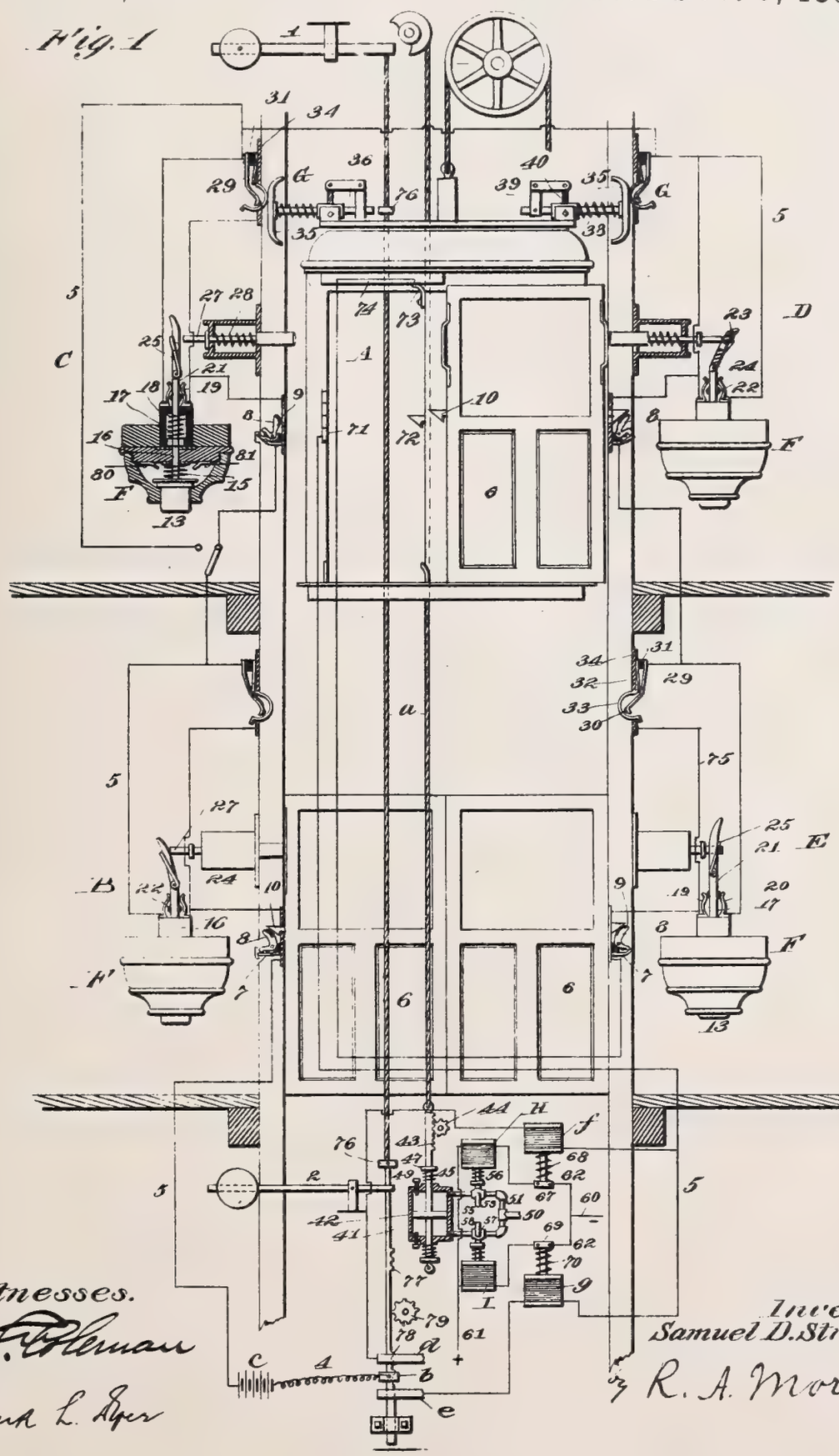
(No Model.) 5 Sheets—Sheet 1.

S. D. STROHM.

ELECTRICALLY CONTROLLED ELEVATOR.

No. 570,827. Patented Nov. 3, 1896.

Fig. 1



Witnesses.

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(No Model.) 5 Sheets—Sheet 2

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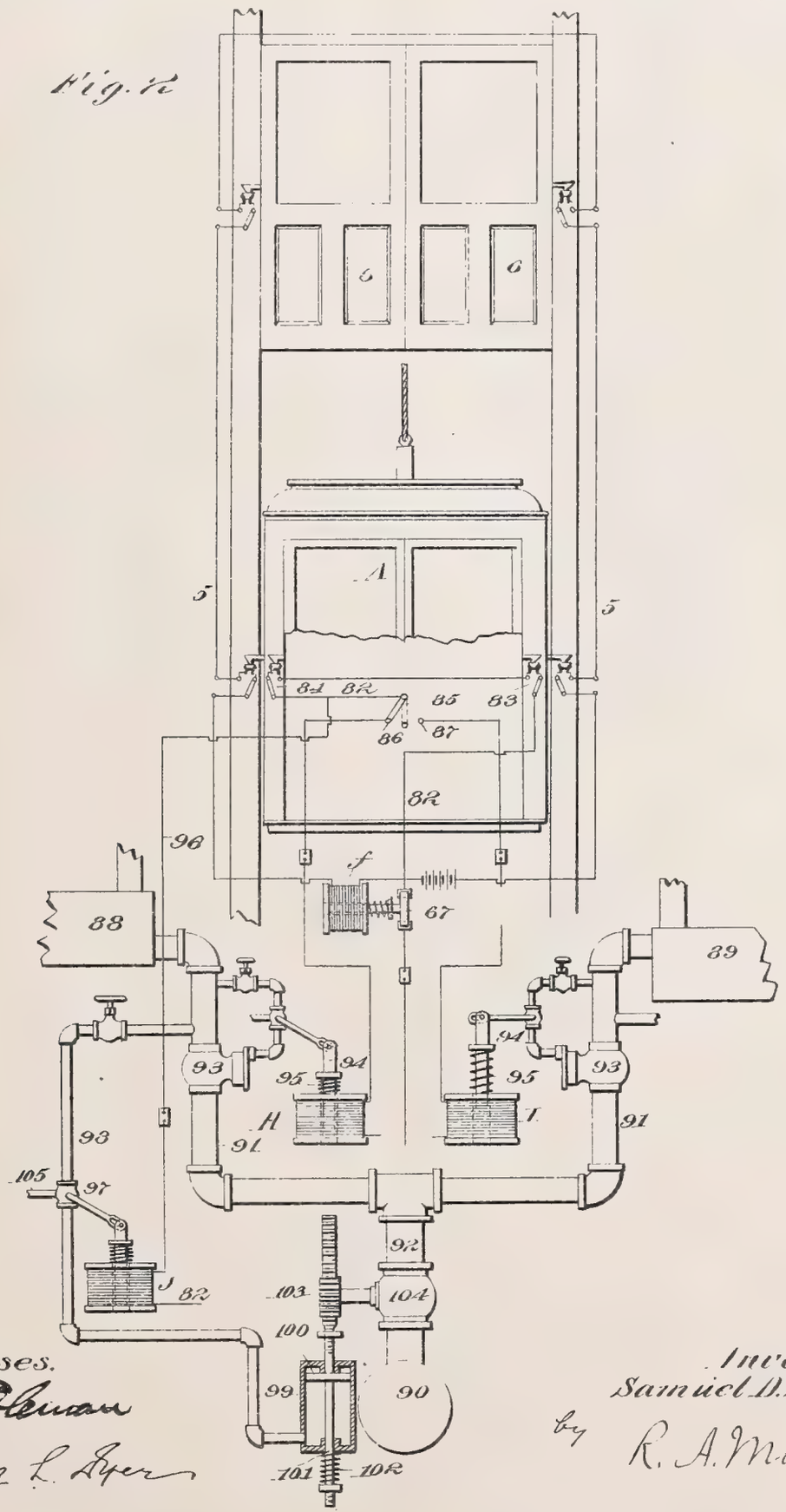
Fig. 2.



Witnesses.
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Fig. 3

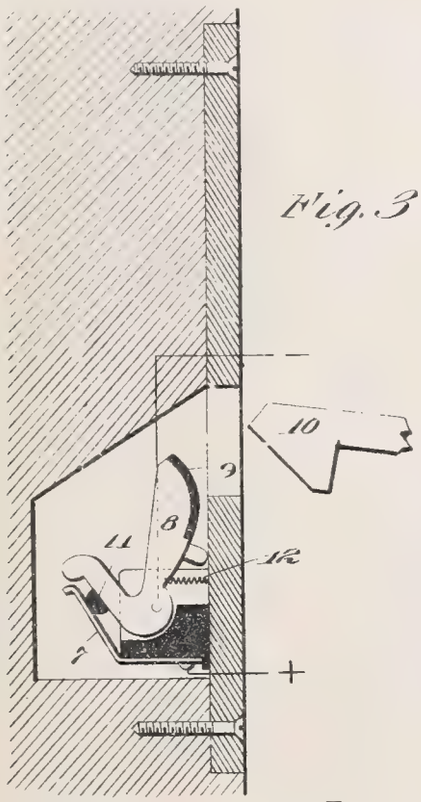


Fig. 4

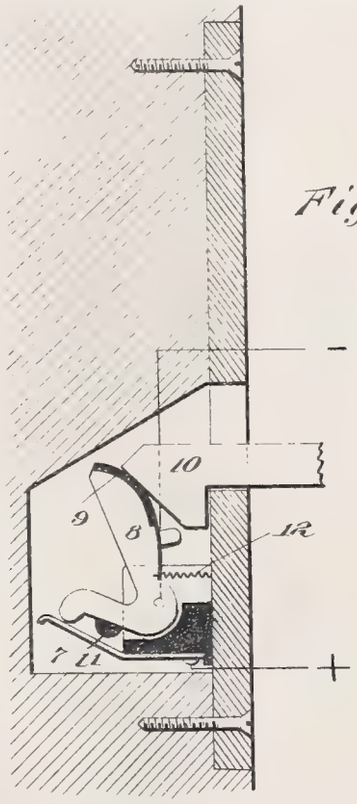


Fig. 5

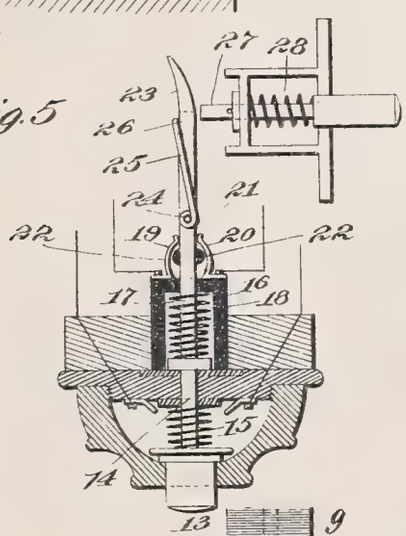


Fig. 6

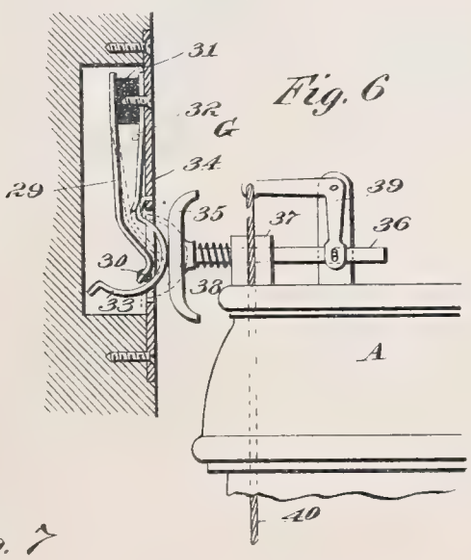
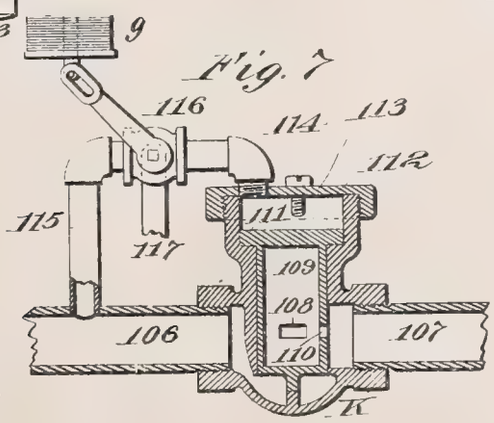


Fig. 7



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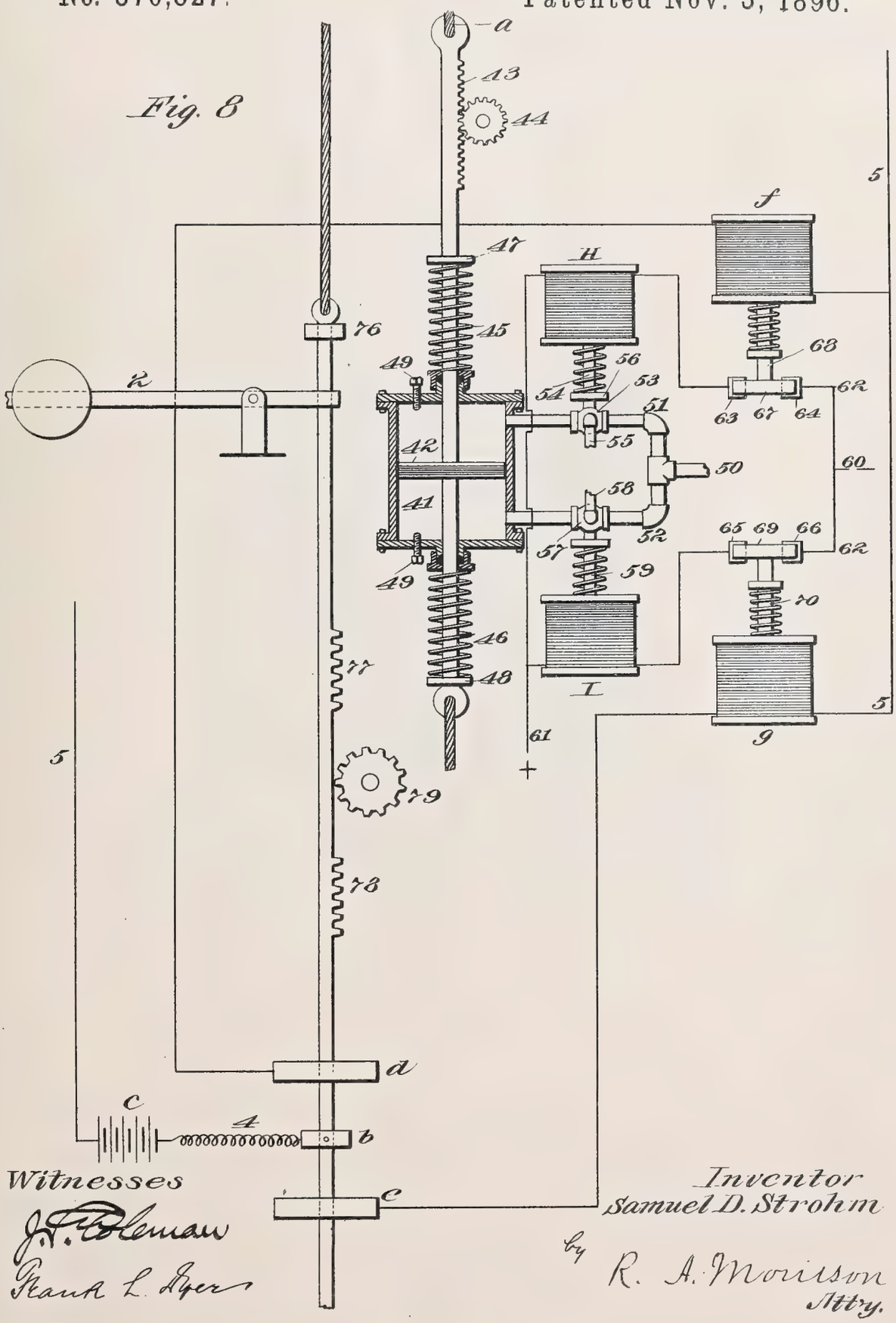
(No Model.) 5 Sheets—Sheet 4.

S. D. STROHM.

ELECTRICALLY CONTROLLED ELEVATOR.

No. 570,827. Patented Nov. 3, 1896.

Fig. 8



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ELECTRICALLY CONTROLLED ELEVATOR.

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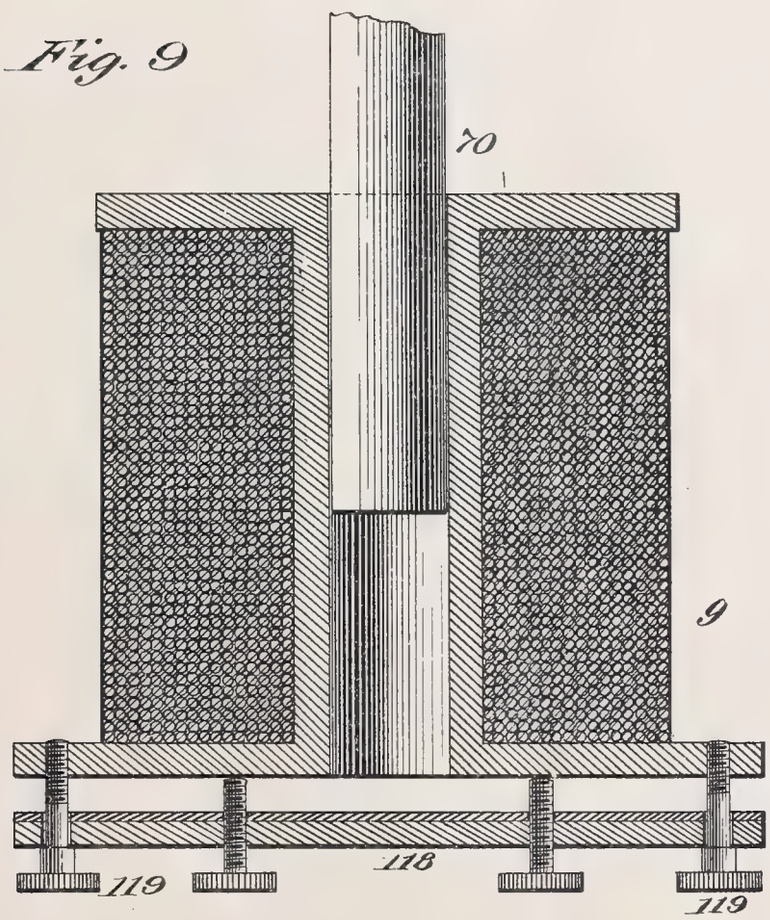
Fig. 9



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UNITED STATES PATENT OFFICE.

SAMUEL D. STROHM, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE STROHM ELEVATOR SAFETY DEVICE COMPANY, OF SAME PLACE.

ELECTRICALLY-CONTROLLED ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 570,827, dated November 3, 1896.

Application filed April 4, 1896. Serial No. 586,211. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL D. STROHM, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Elevators, (Case A;) and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to various new and useful improvement in elevators, and more particularly to elevators which are controlled or operated by electrical means; and the object of the invention is to improve and simplify the construction and operation of such elevators.

My invention is capable of being applied to and carried out in connection with any elevator irrespective of type or motor mechanism.

By means of my invention an elevator equipped as I will describe will be rendered absolutely safe in operation, it being impossible to start the elevator when any one of the landing-doors is opened or is otherwise in an unsafe or insecure condition. Moreover, with my present invention, should the elevator-car be in operation and any one of the landing-doors be then opened or unfastened the elevator will be immediately brought to rest.

By means of my invention also the elevator can be automatically stopped at any one of the landings by a person thereat without the need of an operator in the car, so that the elevator will thereby practically be an automatic one.

Other features of novelty and utility will be presently described, and embodied in the claims.

In order that my invention may be better understood, attention is directed to the accompanying drawings, forming a part of this specification, and in which—

Figures 1 and 8 are diagrammatic views of a hydraulic passenger-elevator equipped with my invention and illustrating the manner of controlling the elevator by a valve-rope passing through the car; Fig. 2, a similar view of the same, illustrating a method of controlling the motor mechanism by means of a switch carried on the car. Figs. 3 and 4 are details of a convenient form of circuit breaker or closer for the safety-circuit, operated by the latch or other fastening device of the landing-doors; Fig. 5, a sectional view of the elevator-controlling push-button shown in Fig. 1; Fig. 6, a detail view of the circuit-closer for breaking the safety-circuit by the elevator-shoe, as will be explained; Fig. 7, a sectional view, partly in elevation, of the preferred form of electrical valve employed; and Fig. 9, a sectional view of the preferred construction of solenoid.

In all of the above views corresponding letters and numerals of reference indicate the same parts.

A represents an elevator-car movable in an ordinary well or shaft and operated by a rope or cable in any suitable way.

B, C, D, and E indicate stations in the building at which the elevator is adapted to stop and from which it may be controlled.

In Fig. 1 the stations C and D are shown on one floor, and the stations B and E are shown on the floor below the same, but there may be separate stations or more than one station at each floor.

a is a controlling rope or rod vertically arranged in the elevator shaft or well, and which extends through the car, said rope or rod being counterbalanced by means of counterbalance-levers 1 and 2 and being guided at its lower end by a suitable sleeve 3, as shown. Carried near the lower end of said controlling rope or rod is a contact-plate *b*, insulated from the same and connected by a wire 4 to one side of the battery *c* or other source of supply.

d e are contact-plates with which the plate *b* is adapted to make contact, according to the position to which the controlling-rope is moved.

5 is a safety-circuit extending through circuit breakers or closers controlled by each of the landing-doors 6, and which, when in its operative condition, enables the hydraulic apparatus of the elevator to be controlled. In

the present instance this circuit is normally closed, in which case said mechanism may be operated.

Preferably the circuit closing or breaking device at the landings are actuated by the latches of the landing-doors, so that in order that said circuit may be put into its operative condition it is necessary that all of the landing-doors shall not only be closed but shall be actually secured. A convenient form of circuit-closing device is illustrated in Figs. 3 and 4, but it may be observed that the construction of the same is capable of many modifications which will suggest themselves to others skilled in the art, and I therefore do not wish to be limited to any particular form of device.

Having reference to the circuit-closer illustrated, 7 represents a suitable insulated spring, which is adapted to make contact with a shoe 8, pivotally mounted adjacent to said spring. Said shoe is provided with a face 9, of insulating material, with which the latch 10 of the landing-door 6 is adapted to come into contact, so as to make contact between the shoe 8 and the spring 7 and close the safety-circuit at that point. The shoe 8 is also provided with an insulating knob or button 11 thereon, which, when said shoe is forced to its retracted position by means of the spring 12, when the door is unfastened, comes into contact with the spring 7 and breaks the safety-circuit, as will be understood.

All of the parts described are carefully insulated from the iron-work of the elevator structure, so that there can be no danger of grounds forming to short-circuit the battery.

A convenient arrangement of elevator-controlling push-button, which is also included in the safety-circuit, is shown in Fig. 5 and is lettered F in the other views.

13 is a suitable push-button mounted in a casing and connected with a rod 14, said push-button being normally forced to its outward position by a spring 15, surrounding said rod. The push-button is made, preferably, of insulated material, such as porcelain or fiber. At the back of said push-button is an insulated sleeve 16, in which works a plunger 17, with which the end of the rod 14 engages when the button 13 is pushed inwardly, said plunger being normally forced outward by a spring 18.

19 and 20 are two contact-springs carried on the end of the sleeve 16 and making contact normally with a rod 21, which may be a continuation of the plunger 17. Said rod also carries one or more insulated studs or buttons 22, which, when the plunger 17 is pushed inwardly, engage beneath the springs 19 and 20, so as to break the circuit at these points.

23 is a shoe pivoted on the end of the rod 21 at 24, and normally held in a position parallel with said rod by a spring 25, a stop (not shown) or other means being provided for preventing said shoe from being forced to a position beyond that point. Said shoe 23 is provided with a curved forward end and with an opening 26 therein.

27 is a stud carried in a suitable framework and adapted to be forced to a retracted position by means of a spring 28. Said stud is normally held in the position shown at B and D, Fig. 1, so as to force the shoe 23 out of line parallel with the rod 21, as will be understood.

When one or more circuit-closing push-buttons such as I have explained are included in the safety-circuit, it is also desirable to include therein a circuit-breaking device, whereby the safety-circuit will be broken by a shoe carried on the elevator-car, for the purpose to be explained, and a convenient form of circuit-breaker for this purpose is shown in Fig. 6 at G.

29 is a contact-spring having an insulated button or knob 30 at its free end and secured at the top to an insulating-block 31, and 32 is a second contact-spring secured to the under side of said block and with which the spring 29 normally makes contact, so as to close the safety-circuit.

33 is a U-shaped circuit-breaking spring carried by a plate 34, and normally extending through an opening in said plate, said spring being adapted to be forced inward to the position shown in Fig. 6, coming in contact with the insulating button or knob 30, so as to break the circuit between the springs 29 and 32. This is effected by means of a shoe 35, carried on a rod 36, which rod works in a bearing 37 at the top of the elevator, being held normally in its outward position by a heavy spring 38. When desired, said shoe may be drawn to a retracted position by means of a bell-crank lever 39, operated by a rope 40 from the elevator or by other means. In this condition the car will operate as an express-elevator and be thrown out of control of the various landing push-buttons, as will be explained.

41 is a cylinder mounted at any suitable point, in the present instance being at the bottom of the elevator shaft or well, and 42 is a piston working in said cylinder. The piston-rod of said cylinder extends through stuffing-boxes at the ends thereof, and said piston is formed with a rack 43 thereon, which engages with a pinion 44, to which the main actuating-valve is connected. The piston 42 is normally centered in the cylinder 41 by springs 45 and 46, said springs being seated upon adjusting-nuts 47 and 48, by which the tension thereof may be regulated, so that said piston will be normally properly centered. If desired, stop-screws 49 may be provided for limiting the throw of the piston 42, as will be understood.

50 is a main supply-pipe connected with any suitable source of fluid-pressure, such as with the pump which operates the elevator, and 51 and 52 are branch pipes connect-

ing said main pipe with the ends of the cylinder 41, above and below the piston 42.

53 is a three-way valve in the branch pipe 51, controlled by a core 54 of a solenoid H. 55 represents the overflow-pipe from said valve. Normally the valve 53 connects the interior of the cylinder 41 with said overflow-pipe and cuts off supply from the main pipe 50, said valve being held in this position by means of a spring. If desired, an insulating-block 56 may be interposed between the core 54 and the valve-stem, so as to prevent the possibility of any ground forming to the pipe in case of a leakage from the solenoid H to its core.

In the branch pipe 52 is a valve 57, having an overflow-pipe 58 and operated by a core 59 of the solenoid I in the same manner as I have explained. The solenoids H and I are included in a circuit 60 61, supplied, preferably, from the lighting-mains of the building, there being a separate branch or shunt circuit 62 for each solenoid. Each of said branch circuits is provided with two contact-plates 63 and 64 and 65 and 66, arranged in pairs therein, as shown. A switch-arm 67 is adapted to make contact between the contact-plates 63 and 64, being carried on a core 68 of the solenoid or relay-magnet *f*, and a switch-arm 69 is adapted to make contact with the contact-plates 65 and 66, said switch-arm being carried on a core 70 of a solenoid or relay-magnet *g*. These solenoids or relay-magnets *f* and *g*, when the safety-circuit through the landing-doors is closed, are adapted to be energized, attracting their cores and breaking the supply-circuits 62 to the solenoids H and I, but when said safety-circuit is broken said switch-arms are forced downward by springs upon the cores 68 and 70, so as to close the circuits 62 and allow the solenoids H and I to be energized.

The relay-magnet *f* is included in a circuit from the plate *d* to the safety-circuit 5, and the solenoid or relay-magnet *g* is included in a circuit from the plate *e* to said safety-circuit. Preferably said safety-circuit extends to the latch 71 of the elevator-car, as shown, being completed through the keeper 72 thereof, thence to a brush 73, carried on the car-door, which brush makes contact with a plate 74, from which plate the other side of said safety-circuit extends to the spring 7 of the circuit-closer at the station E, thence to the shoe 8, thence to the spring 19 on the push-button thereat, thence through the rod 21 to the spring 20, thence to the spring 29, thence to the spring 32, thence by the wire 75 down to the spring 19. From the spring 29 the circuit extends to the other stations of the building in the same way and returns to the other side of the battery or other source of supply *c*.

When the safety-circuit is completed, indicating that all the landing-doors (and, in this instance, the car-door also) are closed, and when circuit-closers of the construction shown are used, indicating that said doors are actually secured, the elevator can be operated by elevating or lowering the controlling rope or rod *a*. It being supposed that said rod is elevated, the contact-plate *b* makes contact with the plate *d*, and the circuit from the battery *c* or other source is thereby completed through the solenoid or relay-magnet and through the safety-circuit 5, extending throughout the building. Said magnet being energized, elevates the switch-arm 67, breaking the circuit 62 of the solenoid II, causing said solenoid to be deënergized and opening the valve 53, so that water or other fluid under pressure flows into the cylinder 41, forcing the piston 43 downward, revolving the pinion 44, and opening the elevator-valve in the proper direction. This will cause the elevator to descend, when it may be stopped by grasping the elevator rope or rod *a* and bringing the contact-plate *b* out of contact with the plate *d*, so as to break the circuit through the solenoid or relay-magnet *f*, allowing the switch-arm 67 to close the circuit between the contact-plates 63 and 64, energizing the solenoid H, and throwing the upper part of the cylinder 41 into communication with the discharge-pipe 50, whereupon the springs 45 and 46 will center the piston 42 in said cylinder and close the elevator-valve.

It will be noted that if any one of the doors is open, or, in this case, if any one of the landing-doors is even unfastened, so as to break the safety-circuit, the elevator cannot be started, because the solenoids or relay-magnets *f* and *g* cannot be energized to break the circuits 62 to solenoids H and I.

In order, therefore, that an elevator equipped with my improved apparatus may be operated, it is absolutely necessary that all of the landing-doors shall be placed in a safe and secure position before the controlling-valve can be actuated.

By providing an elevator with controlling push-buttons at the various landings an absolutely automatic elevator is produced. With such an elevator it is desirable that ordinary stops 76 should be placed upon the controlling rope or rod *a*, so that as the elevator reaches the top or bottom of its movement it will come into contact with one of said stops and move said rope or rod to reverse the circuits through the parts. Said controlling-rope is also preferably provided with two series of rack-teeth 77 78 above and below a pinion 79, which is also connected to the main controlling-valve. This latter arrangement is employed to obviate the danger of the electrically-controlled device failing to arrest the movement of the elevator at the top and bottom of its travel. If the elevator is moved too rapidly, it will be noted that an extreme movement of the controlling rope or rod *a* in either direction will engage the racks 77 or 78 with the pinion 79 and reverse the elevator A automatically. Devices of the kind being therefore used, the elevator will constantly travel up and down in the elevator well or

shaft without requiring attention. When it is desired to stop the elevator at any one of the floors, for instance, at the floor E, the push-button 13 is pushed in, carrying the shoe 23 with it and engaging the plunger 27 within the opening 26 in said shoe, so as to lock the shoe in this position and bring the insulated studs or buttons 22 into contact with the springs 19 and 20, so as to break the safety-circuit between said springs. The push-button 13, being released, is returned to its original position by the spring 15; but this movement does not affect the plunger 17, which is locked in its retracted position, as explained.

Although the safety-circuit has been broken between the springs 19 and 20, it will be observed that the shunt-circuit 75 still remains closed between the springs 29 and 32, so that the circuit to the solenoid or relay-magnet *f* or *g* is still closed.

When the car in its movement up or down approaches the landing at the station E, the shoe 35, carried on the car, will come into contact with the spring 33, forcing the same inward against the insulated button and breaking the shunt-circuit 75 between the springs 29 and 32. The safety-circuit therefore will be broken, deënergizing the solenoid or relay-magnet *f* or *g* and bringing the car to rest, as before explained. When the door at the landing E is then opened, the plunger 27 is forced back out of engagement with the shoe 23, allowing the said shoe to be returned to its original position by means of the spring 18 and closing the safety-circuit between the springs 19 and 20. At this moment the safety-circuit will be broken between the spring 7 and the shoe 8, controlled by the landing-door latch, so that the car does not start. When, however, said landing-door is shut, so as to complete the safety-circuit between the spring 7 and the shoe 8, the elevator will start in the direction it was originally moving, unless the operator desiring to direct the car in the opposite direction shall have moved the controlling rope or rod *a* accordingly.

If it is desired to operate the elevator as an express-elevator, the shoe 35 may be moved inward, so that it will not come into contact with the spring 33 in its movements, whereby the shunt-circuit 75 will always remain closed, irrespective of the breaking of the main safety-circuit between the springs 19 and 20. If desired, also, an ordinary annunciator may be included in a circuit 80 and 81, adapted to be closed by the push-button 13 in a well-known manner, so as to indicate the floor which is calling the elevator.

Instead of controlling the elevator-operating mechanism by electrical means actuated by a valve-rod with respect to which the car travels, as I have explained, it will be obvious that the general principles of my invention are capable of being carried out in a great many ways without departing from the essential spirit thereof, and which will suggest themselves to others skilled in the art.

As an illustration of the capabilities of my invention I have illustrated in Fig. 2 a modification wherein the same essential ideas are present, but in which the elevator is controlled by a switch carried upon the car and adapted to be moved to one side or the other, according to the direction in which the elevator is to be operated, or to be held in a central position when the elevator is to be stopped. Having reference, therefore, to this figure, the car A is operated in a well or shaft in the ordinary way, extending past the several landings, as explained. The safety-circuit 5 extends through circuit breakers or closers operated by the landing-doors and includes therein a single solenoid or relay-magnet *f*. In the present instance the safety-circuit is normally closed through circuit-breakers at the landings, and when in that condition said solenoid or relay-magnet *f* will be energized, indicating that all of the landing-doors are in a safe and secure condition.

The secondary circuit 82 of the solenoid or relay-magnet is adapted to be closed by a switch-arm 67, carried on the core of said solenoid or magnet, so that said secondary circuit will be closed at that point when all the doors are in a safe and secure condition. Said secondary circuit extends through a cable or in any other way to the car A, and first passes through circuit-breakers 83 and 84, controlled by the door or doors of the elevator, so that when said door or doors is or are closed the secondary circuit in the elevator will be closed. Said circuit extends to a switch-arm 85, which is adapted to make contact with the contact-plates 86 and 87 or be held in a central position between said plates, as shown in dotted lines. From said contact-plates separate circuits extend, in each of which is included a solenoid II or I.

88 represents a pressure-tank, in which water under pressure is confined, and 89 is a discharge-tank, into which water is discharged from the main hydraulic cylinder 90 when the elevator is descending. Said pressure or discharge tanks connect by means of a pipe 91 to a pipe 92, which communicates with the main cylinder 90, in front of the piston therein, in the ordinary way. Mounted within each of said pipes 91, on both sides of the pipe 92, are valves 93, which are preferably of special construction, as will be presently explained, but for the purpose of clearness I will assume these valves to be ordinary two-way valves, each of which is connected to the core 94 of the solenoid II or I, as the case may be. The cores of said solenoid are normally held in a retracted position by means of springs 95, so as to maintain said valves 93 normally closed, thereby cutting off communication between the tanks 88 and 89 and the main hydraulic cylinder 90.

It will be noted that the secondary circuit

of the solenoid or relay-magnet *f* may be closed by the switch-arm 85 when all of the landing-doors are in a safe and secure condition. In order to provide additional security and prevent the probability of the elevator mechanism being placed in an operative position when the door or doors of the elevator are not entirely closed, I employ a solenoid or magnet J, included in a shunt 96, extending from the circuit 82, between the circuit-breaker 84 and the switch-arm 85. The core of said solenoid J operates a small three-way valve 97, included in a pipe 98, extending from the pressure-tank 88 or from the pipe 91 above the valve 93 for said pressure-tank. Said pipe 98 connects with the lower end of a cylinder 99, in which is mounted a piston 100, the piston-rod 101 of which extends through stuffing-boxes at the top and bottom of said cylinder. Said piston 100 is normally held in a lowered position by means of a spring 102 on the lower end of said piston-rod 101. The upper portion of said piston-rod is formed with a rack thereon, which engages with a pinion 103, said pinion controlling a valve 104 in the pipe 92. The operation of the modification thus described will be immediately understood.

It being assumed that the safety-circuit 5 is closed, indicating that all of the landing-doors are in a safe and secure condition, so as to energize the solenoid or relay-magnet *f*, the secondary circuit 82 of said solenoid will be closed by means of the switch-arm 67, and it being further assumed that the door or doors of the elevator is or are closed said secondary circuit 82 will be closed at the circuit-breakers 83 84. The secondary circuit 82 being thereby closed through the solenoid J, as shown, said solenoid will be energized, opening the valve 97 and allowing water under pressure to enter the cylinder 99, beneath the piston 100 therein, elevating said piston and opening the valve 104. The switch-arm 85 may now be moved into contact with the contact-plates 86 and 87, being shown in the figure in contact with the former plate. The solenoid H will thereby be energized, attracting its core and opening the valve 93, so that water under pressure flows from the pressure-cylinder 88, through the pipes 91 and 92, into the main hydraulic cylinder 90, moving the piston therein and elevating the car or cage. When the switch-arm 85 is moved out of contact with said plate 86, the solenoid H will be deënergized, closing the valve 93 and stopping the car. When said switch-arm 85 is moved into contact with the other contact-plate, 87, the solenoid I will be energized, opening the valve 93 and allowing the water in the main cylinder 90 to discharge into the tank 89, so that the car or cage will descend.

It will be noted that if one of the elevator-doors is opened or unfastened, so as to break the secondary circuit 82 at the circuit-breaker 83 or 84, or at both of said circuit-breakers, the solenoid J will be deënergized, whereby its core will be retracted, throwing the cylinder 99 into communication with the discharge-pipe 105, in which case the spring 102 will return the piston 100 to its lowermost position and close the valve 104. It will further be noted that if the safety-circuit 5 is broken by the opening or unfastening of any one or more of the landing-doors, whether the elevator-doors are closed or not, the secondary circuit to the solenoid J will be similarly broken, so that the same operation takes place.

It will of course be understood that with the modified form of device shown in Fig. 2 push-buttons may be provided on the landings for stopping the elevator thereat, as explained above, but for the purpose of clearness I have omitted said push-buttons and the accompanying elements from this view.

In order to obtain a very sensitive electrical valve and to be able to operate the same with a minimum amount of current, so that the electrical closing devices may be made as delicate as possible, I prefer to employ the special form of valve illustrated in detail in Fig. 7, to which particular attention is directed.

K is a valve-casing, of the general shape illustrated, to which the supply-pipes 106 107 and the discharge-pipe 108 are connected. The valve 109, which is preferably hollow, normally closes the passage-way between the pipes 106 and 107, and in this position the pipe 107 communicates by a passage 110 in the valve with the discharge-pipe 108.

By making the valve 109 hollow, as I have explained, and by admitting water within the same pressure is equalized therein, so that the valve may be constructed of a minimum amount of metal, and its coefficient of expansion can be therefore made to be practically the same as that of the valve-casing. This is a material and practical advantage, for the reason that with hydraulic elevators working on great pressure the temperature of the water is raised to a very high point, so that there is in consequence considerable expansion of the parts. I find that a solid valve cannot be made to operate satisfactorily, since it expands more than the casing, and I consider it therefore very important to make the valve hollow.

The valve 109 is formed with an integral piston 111 at its upper end, working within a cylinder 112, cast with the valve-casing. Said cylinder is provided with a screw-cap 113, in which is a limiting-screw 114 for regulating the play of the piston 111.

115 is a pipe of small bore connecting the pipe 106 with the top of the cylinder 112, so that normally water under pressure from the pipe 106 is forced upon the piston 111 and upon the bottom of the valve 109. Owing to the difference in area of these parts the valve will normally be kept in the position shown, so as to cut off the supply from the pipe 106 to the pipe 107.

116 is a small three-way valve in the pipe

115, which is normally open, so as to put the pipe 106 into communication with the cylinder 112, and which is adapted to be operated by a magnet or solenoid *f* or *g* to cut off such supply of water and to put such cylinder into communication with an overflow-pipe 117. By means of this device the solenoids or magnets *f* or *g* can be made very small and sensitive and be operated on very little current, since the valve 116, being of such small size, is very easily moved.

The operation of the particular form of valve described is as follows: The magnet or solenoid *f* or *g* being energized, so as to partially rotate the valve 116, the water supply from the pipe 106 is cut off from the cylinder 112 and said cylinder is put into communication with the discharge-pipe 117. The water-pressure on the bottom of the valve 109 will thereby elevate said valve, bringing the discharge-opening therein above the pipe 107, so that water under pressure flows immediately from the pipe 106 to the pipe 107 into a cylinder or elsewhere, such as the main hydraulic cylinder 90. When the magnet or solenoid *g* is energized, so as to return the valve 116 to its original position, cutting off the overflow-pipe 117 and allowing water to flow from the pipe 106 to the cylinder 112, the increase of area of the piston 111 will cause the valve 109 to be returned to its original position, cutting off the supply of water to the pipe 107 and putting said pipe 107 in communication with the discharge-pipe 108.

In practice I also prefer to make use of a solenoid of novel construction, which, in this art, I have found to be of great importance. It may be stated that while I desire at all times to be understood as including an electromagnet in the general expression "solenoid," yet, since the movement of the parts is considerable, a solenoid *per se* is superior to an electromagnet. My experiments have, however, led me to decide that an ordinary solenoid as now constructed is not very desirable for practical use, for the reason that the movement of the core toward its attracted position is uncertain, and the pull or strength of the solenoid decreases as the core enters the same, being strongest when the core is at its retracted position. I have therefore invented a specific form of solenoid wherein the core will be attracted very powerfully and in which the final movements of the core are considerably stronger and more rapid than its first movements, being, in fact, extremely sharp and quick. By this means a valve, switch, or other element may be operated to the best advantage.

In constructing my improved solenoid I prefer to wind an insulated coil preferably upon a brass or other non-magnetic spool and to attach to one of the ends of the solenoid a plate 118, of iron or steel, which becomes strongly magnetized by the coil and acts to attract the core near the end of its movement, so that said core is forcibly drawn against said plate when the solenoid is energized. In order to prevent the core of the solenoid from sticking to said plate when the solenoid is deënergized, I secure upon the under side of said plate a plate of thin brass or other non-magnetic material, although it will be understood that such non-magnetic material may be carried on the end of the core.

To allow for the adjustment of the plate 118, whereby the movement of the core may be regulated, I mount the said plate on adjusting-screws 119, which may be screwed into the end of the solenoid-bobbin more or less for the accomplishment of this purpose.

Concerning my improved solenoid it will be noted that it consists, broadly, of a solenoid-coil for effecting the major movement of a core and a pole-piece for attracting the core toward the end of its movement. I preferably secure the pole-piece at the rear end of the coil and energize said pole-piece by means of the coil. It will be understood that the pole-piece may be located at the forward end of the coil and that the said pole-piece may be energized by a separate coil.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is as follows:

1. In an elevator, the combination of a car or cage, means for operating the same, mechanism for controlling said operating means, a solenoid or magnet for operating said controlling means, a safety-circuit extending through the landings for operating said solenoid or magnet, a push-button at each landing for closing or breaking the safety-circuit, a shunt around each push-button, and a closer or breaker in said shunt operated by the elevator-car, substantially as set forth.

2. In an elevator, the combination of a car or cage, means for operating the same, mechanism for controlling said operating means, a solenoid or magnet for operating said controlling mechanism, a safety-circuit including said solenoid and extending adjacent to the elevator-shaft, a push-button at each landing for making or breaking said safety-circuit, a shunt around each push-button, a closer or breaker in said shunt, and a shoe carried on the elevator for operating said closer or breaker, substantially as set forth.

3. In an elevator, the combination of a car or cage, means for operating the same, mechanism for controlling said operating means, a solenoid or magnet for operating said controlling mechanism, a safety-circuit including said solenoid or magnet and extending adjacent to the elevator-shaft, a push-button at each landing for closing or breaking said safety-circuit, a shunt around each push-button, a closer or breaker in each shunt, a shoe carried on the elevator-car for operating said closers or breakers, and means for withdrawing said shoe and for holding the same in a retracted position, substantially as set forth.

4. In an elevator, the combination of an elevator car or cage, means for operating the

same, controlling mechanism for said operating means, a solenoid or magnet for operating said controlling mechanism, a safety-circuit including said solenoid or magnet and extending adjacent to the elevator-shaft, a push-button at each landing for closing or breaking said safety-circuit, means controlled by the landing-doors for locking said push-buttons in their retracted positions, to maintain the safety-circuit closed or broken through the same, a shunt around each push-button, a closer or breaker in each shunt, and means carried by the car for operating said circuit closers or breakers, substantially as set forth.

5. In an elevator, the combination of a car or cage, means for operating the same, controlling mechanism for said operating means, a solenoid or magnet for operating said controlling mechanism, a safety-circuit including said solenoid or magnet and extending adjacent to the elevator-shaft, a push-button at each landing for breaking or closing the safety-circuit, a latch controlled by each landing-door for maintaining the push-button thereat in its retracted position to maintain the safety-circuit closed or broken, a shunt around each push-button, a closer or breaker in said shunt, and means carried by the car for operating said closer or breaker, substantially as set forth.

6. In an elevator, the combination of a car or cage, means for operating the same, controlling mechanism for said operating means, a solenoid or magnet for operating said controlling mechanism, a safety-circuit including said solenoid or magnet, and extending adjacent to the elevator-shaft, a push-button at each landing for closing or breaking the safety-circuit, a shoe pivoted to the moving elements of said push-button, a spring-pressed plunger for engaging said shoe when the latter is moved to make or break the safety-circuit at each landing, said plunger being retracted from such engagement when the landing-door is opened, a shunt around each push-button, a closer or breaker in each shunt, and means carried by the car for operating said closer or breaker, substantially as set forth.

7. In an elevator, the combination of a car or cage, means for operating the same, controlling mechanism for said operating means, a solenoid or magnet for operating said operating mechanism, a safety-circuit including said solenoid or magnet and extending adjacent to the elevator-shaft, and a push-button mechanism, at each landing, comprising a casing a spring-pressed push-button, a separate plunger engaged by said push-button for making or breaking the safety-circuit, a shoe pivoted to said plunger, a second plunger with which said shoe engages, normally held in position to be engaged by said shoe by the closing of the landing-door, and adapted to be disengaged from said shoe when the landing-door is opened, substantially as set forth.

8. In an elevator, the combination of a car or cage, means for operating the same, controlling mechanism for said operating means, a solenoid or magnet for operating said controlling mechanism, a safety-circuit including said solenoid or magnet and extending adjacent to the elevator-shaft, and a push-button mechanism at each landing comprising a casing, a push-button mounted in said casing, an annunciator-circuit operated by said push-button, a separate plunger also operated by said push-button and adapted to break the safety-circuit, a shoe carried by said plunger, a second plunger with which said shoe is engaged, normally held in a position to be engaged by said shoe by the closing of the landing-door, but adapted to be withdrawn from said shoe when the landing-door is opened, and a shunt around said push-button, substantially as set forth.

9. In an elevator, the combination of a car or cage, means for operating the same, controlling means for said operating mechanism, a solenoid or magnet for operating the said controlling mechanism, a safety-circuit including said solenoid or magnet, and push-button mechanism at each landing comprising a casing, a push-button mounted in said casing, a separate plunger operated by said push-button, insulated buttons on said plunger, a pair of contact-springs with which the plunger normally engages, a shoe carried on said plunger, a second plunger with which said shoe engages but adapted to be withdrawn from the shoe on the opening of the landing-doors, and a shunt around said push-button, substantially as set forth.

10. In an elevator, the combination of a car or cage, means for operating the same, controlling mechanism for said operating means, a solenoid or magnet for operating said controlling mechanism, a safety-circuit including said solenoid or magnet and passing through circuit closers or breakers controlled by the latches of the landing-doors, and mechanism for each landing for controlling said solenoid or magnet, substantially as set forth.

11. In an elevator, the combination with a car or cage, means for operating the same, controlling mechanism for said operating means, a cylinder, a piston in said cylinder, connections between said piston and the controlling mechanism, a pipe or pipes for normally supplying liquid under pressure to both ends of said cylinder, a valve at each of said pipes, a solenoid or magnet for controlling each valve, and means under the control of the operator on the car for energizing either of said solenoids or magnets, substantially as set forth.

12. In an elevator, the combination of a car or cage, a cylinder, a piston in said cylinder, connections between said piston and the controlling mechanism, means for normally centering said piston for maintaining the controlling mechanism in an inactive condition, pipes leading to both ends of the cylinder, a

valve in each pipe, a solenoid or magnet for controlling each valve, and means under the control of the operator for energizing either end of said solenoids or magnets, substantially as set forth.

13. In an elevator, the combination of a car or cage, means for operating the same, controlling mechanism for said operating means, a cylinder, a piston in said cylinder, connections between said piston and controlling means, pipes leading to both ends of said cylinder, and normally supplying a liquid under pressure thereto, a valve in each pipe adapted to shut off the supply of liquid to either end of the cylinder and put the same in communication with a discharge-pipe, a solenoid or magnet for operating each valve, and means under the control of the operator on the car for energizing either one of the solenoids or magnets, substantially as set forth.

14. In an elevator, the combination of a car or cage, means for operating the same, controlling mechanism for said operating means, a cylinder, a piston in said cylinder, connections between said piston and the controlling mechanism, pipes connecting with both ends of said cylinder, a valve in each pipe, a solenoid or magnet for operating each valve, a switch in the circuit to each solenoid, a relay-magnet or solenoid for operating each switch, and a safety-circuit including said relay-magnets or solenoids, said safety-circuit extending through circuit closers or breakers controlled by the landing-doors, substantially as set forth.

15. In an elevator, the combination of a car or cage, means for operating the same, controlling mechanism for said operating means, a cylinder, a piston in said cylinder, connections between said piston and the controlling mechanism, pipes connecting with both ends of said cylinder, a valve in each pipe, a solenoid or magnet for operating each valve, a switch in the circuit to each solenoid, a relay-magnet or solenoid for operating each switch, and a safety-circuit including said relay-magnets or solenoids, said safety-circuit extending through circuit closers or breakers controlled by the latches of the landing-doors, substantially as set forth.

16. In an automatic elevator, the combination of means for causing an elevator to travel continuously up or down in an elevator shaft or well, and mechanism at each landing controlling the operating mechanism of the elevator, whereby the elevator may be stopped at any landing, substantially as set forth.

17. In an elevator, the combination of means for causing the elevator to continuously travel up and down in an elevator shaft or well, a push-button at each landing controlling the operating mechanism for the elevator, and a circuit breaker or closer at each landing controlled by a shoe carried on the elevator car or cage and adapted to coact with the said push-button, whereby when said push-button is operated the movement of the car in actuating said circuit closer or breaker will bring the car to rest, substantially as set forth.

18. In an elevator, the combination of a car or cage, means for operating the same, controlling mechanism for said operating means, a cylinder, a piston in said cylinder, connections between said piston and the controlling mechanism, pipes leading into said cylinder at both ends thereof, a valve in each pipe, a solenoid or magnet for operating each valve, a stationary contact-plate in circuit with each solenoid or magnet, a contact-plate movable between said stationary plates and controlled by the operator on the car, and a safety-circuit including said contact-plates extending through circuit closers or breakers controlled by the landing-doors, substantially as set forth.

19. In an elevator, the combination of a car or cage, means for operating the same, controlling mechanism for said operating means, a cylinder, a piston in said cylinder, connections between said piston and the controlling mechanism, pipes leading into said cylinder at both ends thereof, a valve in each pipe, a solenoid or magnet for operating each valve, a stationary contact-plate in circuit with each solenoid or magnet, a contact-plate movable between said stationary plates and controlled by the operator on the car, and a safety-circuit including said contact-plates extending through circuit closers or breakers controlled by the latches of the landing-doors, substantially as set forth.

20. In an elevator, the combination of a car or cage, a hydraulic cylinder, pipes connecting the ends of said cylinder with the pressure supply, a three-way valve in each of said pipes normally conveying the pressure to both ends of the cylinder, a solenoid or magnet for operating each valve for cutting off the pressure to either end of the cylinder and connecting the same with the discharge, and a switch controlled from the car or cage for energizing said solenoid or magnet, substantially as set forth.

21. In an elevator, the combination of a car or cage, a hydraulic cylinder, pressure and discharge pipes connected with said cylinder, a valve on each of said pipes, a solenoid or magnet for operating each of said valves, a switch carried on the car for energizing either of said solenoids or magnets, a switch in the circuit of said solenoids or magnets, a relay-magnet or solenoid for operating said switch, and a safety-circuit including said solenoid or magnet and extending through closers or breakers controlled by the landing-doors, substantially as set forth.

22. In an elevator, the combination of a car or cage, a hydraulic cylinder, pressure and discharge pipes connected with said cylinder, a valve on each of said pipes, a solenoid or magnet for operating each of said valves, a switch carried on the car for energizing either of said solenoids or magnets, a switch in the

circuit of said solenoids or magnets, a relay-magnet or solenoid for operating said switch, and a safety-circuit including said solenoid or magnet and extending through closers or breakers controlled by the latches of the landing-doors, substantially as set forth.

23. In an elevator, the combination of a car or cage, hydraulic mechanism for operating the elevator, a valve in the main supply-pipe, a cylinder, a piston in said cylinder, connections between said piston and said valve, a pipe supplying water under pressure to said cylinder on one side of said piston, a valve in the latter pipe, a solenoid or magnet for operating the latter valve, and a safety-circuit extending through said solenoid or magnet and including closers or breakers controlled by the landing-doors, substantially as set forth.

24. In an elevator, the combination of a car or cage, hydraulic mechanism for operating the elevator, a valve in the main supply-pipe, a cylinder, a piston in said cylinder, connections between said piston and said valve, a pipe supplying water under pressure to said cylinder on one side of said piston, a valve in the latter pipe, a solenoid or magnet for operating the latter valve, and a safety-circuit extending through said solenoid or magnet and including closers or breakers controlled by the latches of the landing-doors, substantially as set forth.

25. In an elevator, the combination of a car or cage, hydraulic mechanism for operating the elevator, a main supply-pipe, a valve in said pipe, a pinion on said valve, a cylinder, a piston in said cylinder, a rack connected to said piston and engaging said pinion, a spring for normally keeping said piston at one end of said cylinder, a pipe leading into said cylinder at the same end, a valve in said pipe, a solenoid or magnet for operating said valve, a circuit for said solenoid or magnet, a switch in said circuit, a relay-magnet or solenoid for operating said switch, and a safety-circuit including said relay-magnet or solenoid extending through the closers or breakers formed by the landing-doors, substantially as set forth.

26. In an elevator, the combination of a car or cage, hydraulic mechanism for operating the elevator, a main supply-pipe, a valve in said pipe, a pinion on said valve, a cylinder, a piston in said cylinder, a rack connected to said piston and engaging said pinion, a spring for normally keeping said piston at one end of said cylinder, a pipe leading into said cylinder at the same end, a valve in said pipe, a solenoid or magnet for operating said valve, a circuit for said solenoid or magnet, a switch in said circuit, a relay-magnet or solenoid for operating said switch, and a safety-circuit including said relay-magnet or solenoid extending through the closers or breakers formed by the latches of the landing-doors, substantially as set forth.

27. An improved circuit closer or breaker operated by a latch comprising a pivoted shoe, an insulating button or knob carried on said shoe, and a contact-spring engaged by said button or knob when the shoe is moved to one position and engaged by the shoe itself when in another position, substantially as set forth.

28. An improved circuit closer or breaker operated by a latch comprising a shoe, an insulated face on said shoe with which the latch engages, an insulating knob or button on said shoe, and a spring engaged by said knob or button when the shoe is in one position, and by the shoe itself when in another position, substantially as set forth.

29. An improved push-button for the purpose mentioned, comprising a casing, a push-button 13 in said casing, a spring 15 for said push-button, a sleeve 16 secured to said casing, a plunger 17 mounted within said sleeve, a spring 18 for said plunger, a rod 21 carried by said plunger, insulating buttons or knobs on said rod, contact-springs 19 and 20 normally engaging said rod, and a shoe 23 pivoted to said rod, substantially as set forth.

30. An improved valve, comprising a valve-casing, pipes 106, 107, entering the same at opposite sides, a discharge-pipe connecting with the same between the pipes 106, 107, a valve centrally located in said valve-casing and having a piston on one of its ends, a cylinder for receiving said piston and formed integral with the valve-casing, a pipe 115 connecting the pipes 106, 107 with said cylinder, and an auxiliary valve in said pipe, substantially as set forth.

31. An improved electric valve, comprising a valve-casing, a cylinder connected to said casing, a valve in said casing, a piston mounted in said cylinder and connected with said valve, a stop-screw for adjusting the supply of said valve, a branch pipe for normally supplying pressure to said cylinder, a valve in said branch pipe, and a solenoid or magnet for operating the latter valve, substantially as set forth.

32. In an improved electric valve, the combination of a valve-casing K, pipes 106, 107 leading to and from said casing, a valve 109 in said casing, the exit-pipe 108 normally connected to the pipe 107, the cylinder 112 integral with the valve-casing, the piston 111 in said cylinder integral with the said valve, the branch pipe 115 connecting the pipe 106 with the cylinder 112, the valve 116 in said branch pipe, the discharge-pipe 117, and a solenoid or magnet connected to said valve 116, substantially as set forth.

33. In an improved electric valve, the combination of the valve-casing K, pipes 106 and 107 leading to and from said casing, the valve 109 in said casing, the exit-pipe 108 normally connected to the pipe 107, the cylinder 112 integral with the valve-casing, the piston 111 in said cylinder integral with the said valve, the stop-screw 114, the branch pipe 115 connecting the pipe 108 with the cylinder 112 and the valve 116 in said branch pipe, the dis-

charge-pipe 117, and the solenoid or magnet connected to said valve 116, substantially as set forth.

34. An improved solenoid, comprising a coil, a core movable in said coil, and a magnetized disk or plate parallel with the rear end of the coil and magnetized by the same, said disk or plate attracting the core during its final movements, substantially as set forth.

35. An improved solenoid, comprising a coil, a core movable in said coil, a disk or plate at the rear of the coil and adjustably secured thereto and magnetized by the coil, said disk or plate attracting the core during its final movements, substantially as set forth.

36. An improved solenoid, comprising a coil, a core movable in said coil, a disk or plate at the rear of the coil and adjustably secured thereto and magnetized by the coil, said disk or plate attracting the core during its final movements, and a non-magnetic plate interposed between said magnetized disk and the core, substantially as set forth.

This specification signed and witnessed this 12th day of March, 1896.

SAMUEL D. STROHM.

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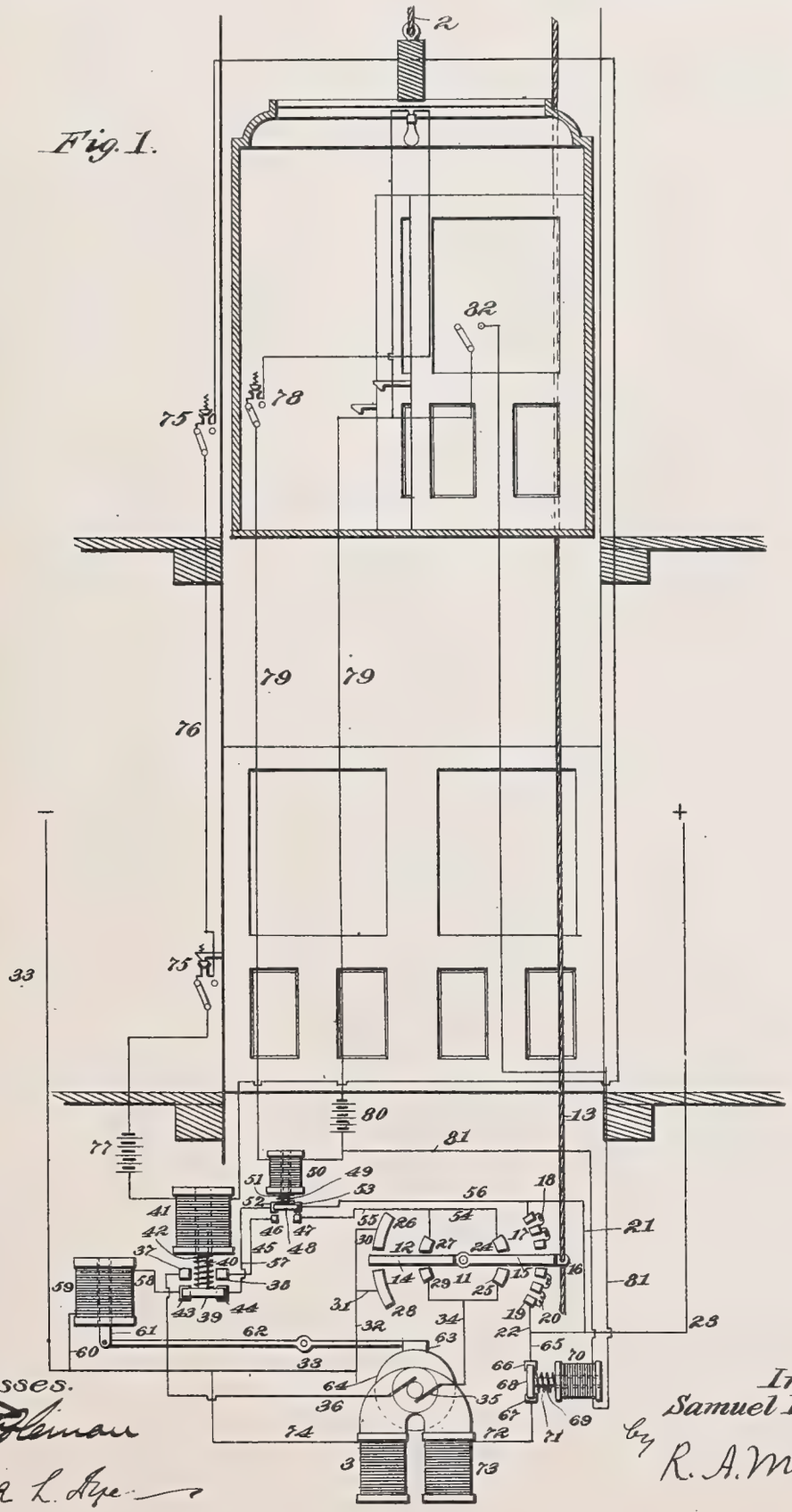
(No Model.) 4 Sheets—Sheet 1.

S. D. STROHM.

ELECTRIC ELEVATOR.

No. 579,024. Patented Mar. 16, 1897.

Fig. 1.



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THE NORRIS PETERS CO., WASHINGTON, D. C.

(No Model.)

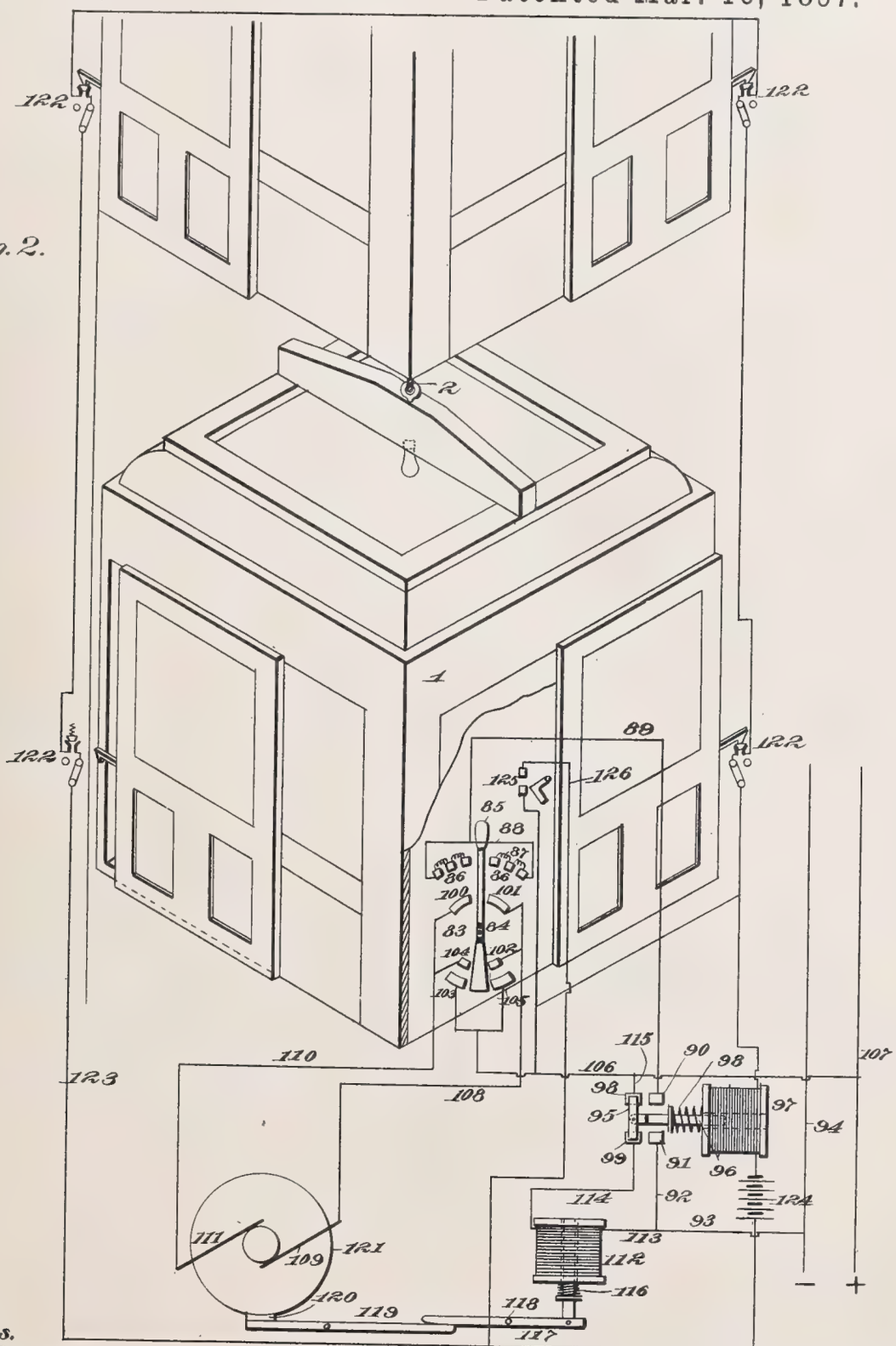
4 Sheets—Sheet 2.

S. D. STROHM.

ELECTRIC ELEVATOR.

No. 579,024. Patented Mar. 16, 1897.

Fig. 2.



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(No Model.) 4 Sheets—Sheet 3.

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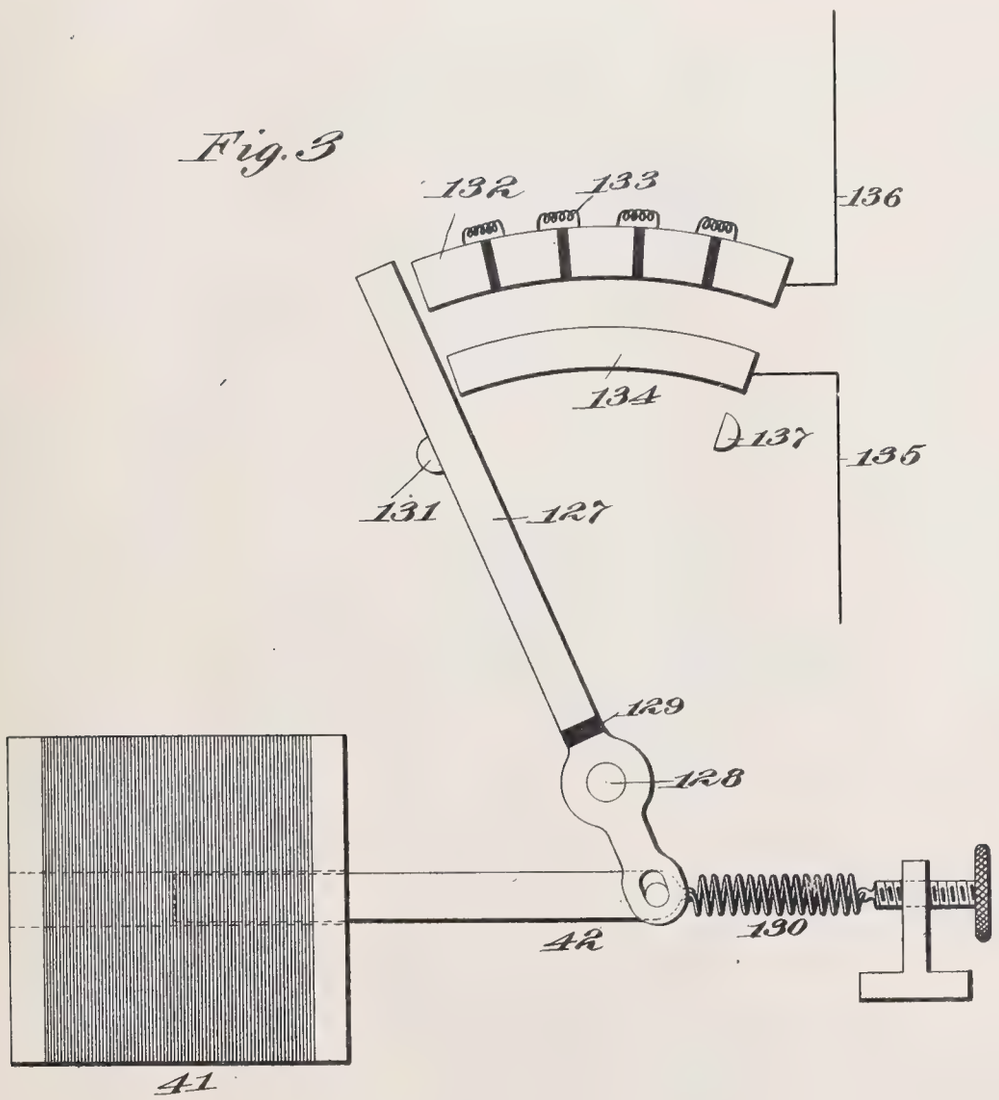
ELECTRIC ELEVATOR.

No. 579,024. Patented Mar. 16, 1897.

Fig. 3



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(No Model.) 4 Sheets—Sheet 4.

S. D. STROHM.

ELECTRIC ELEVATOR.

No. 579,024. Patented Mar. 16, 1897.

Fig. 6.

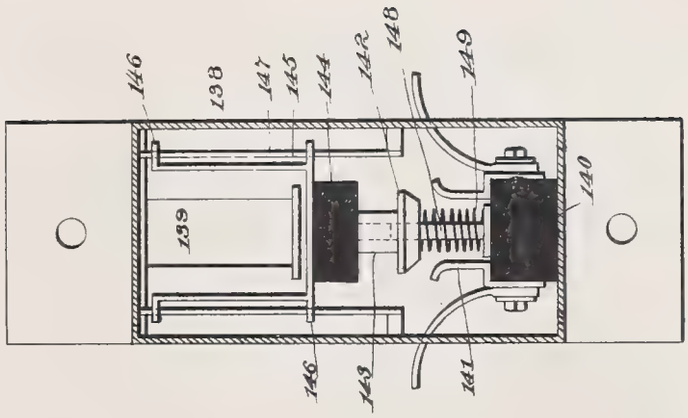


Fig. 5

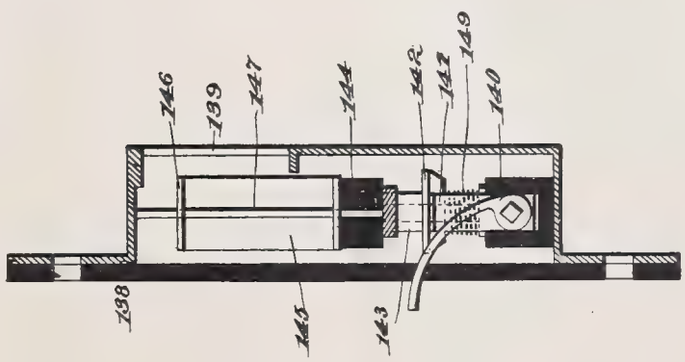
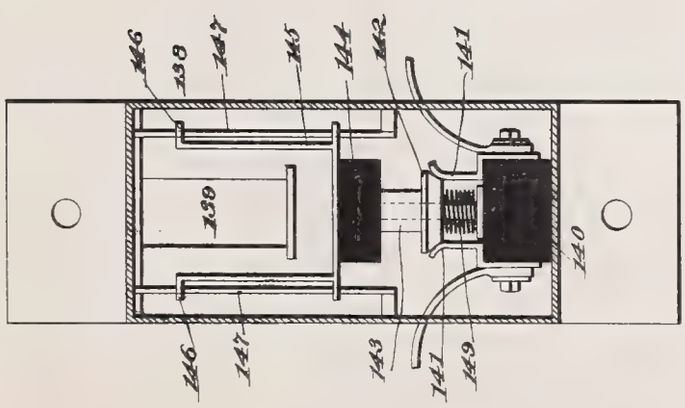


Fig. 4.



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per Frank L. Ayers
Associate Atty

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

SAMUEL D. STROHM, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE STROHM ELEVATOR SAFETY DEVICE COMPANY, OF SAME PLACE.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 579,024, dated March 16, 1897.

Application filed April 4, 1896. Serial No. 586,215. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL D. STROHM, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Electric Elevators, (Case E;) and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to various new and useful improvements in electric elevators; and the main object of the invention is to so construct an elevator operated by an electric motor or motors as to improve and render more perfect the means for controlling said motor or motors, and to further provide an improved safety device to be used in connection with said elevator whereby absolute safety in operation of the elevator will be assured.

In order that my invention may be better understood, attention is directed to the accompanying drawings, wherein I illustrate two ways of carrying into effect the general principles of my invention, and in which—

Figure 1 is a diagrammatic view illustrating a convenient form of apparatus wherein the rheostat and controlling-switches are operated by the controlling-rope from the elevator-car; Fig. 2, a similar view showing the rheostat and controlling-switches carried on the car; Fig. 3, a similar view of the preferred arrangement of circuit-breaking switch for the motor-circuits or elsewhere; Fig. 4, a rear elevation, partly in section, of a convenient form of circuit-breaking device adapted to be operated by the latches of the landing-doors; Fig. 5, a sectional view of the same; and Fig. 6, a view similar to Fig. 4, except that the contact-plate is out of contact with the contact-springs, so as to break the circuit.

In all of the above views corresponding parts are represented by the same figures of reference.

Having reference to Fig. 1, the motor 3 operates the car 1 through the rope or cable 2, said motor in this instance being located at the bottom of the elevator-shaft.

11 represents a controlling-switch or rheostat for the motor, located adjacent thereto and having a switch-arm 12, adapted to be moved up and down by a controlling-rope 13. Said switch-arm is preferably divided into three parts 14, 15, and 16, mechanically connected together, but electrically insulated from each other, as shown.

17 is a series of contact-plates connected together by resistance-coils 18 and mounted above the switch-arm 12, and 19 is a corresponding series of contact-plates connected together by resistance 20 beneath said switch-arm. The extreme plates 17 and 19 of these two series are connected by wires 21 and 22 to one of the mains 23 of the electric-light circuit of the building or to any other source of supply.

24 is a contact-plate above the portion 15 of the switch-arm, and 25 is a corresponding contact-plate below the same, said contact-plates being in advance of the pivotal point of said switch-arm. Behind the pivotal point of said switch-arm are two contact-plates 26 and 27 above the same and two plates 28 and 29 below the same. The plates 26 and 28 are connected by wires 30, 31, and 32 with the other main 33 of the electric-light circuit of the building or other source of supply.

34 is a wire connected between the plates 25 and 29 with one of the brushes 35 of the motor 3.

36 is a wire connecting the other brush of said motor with a contact-plate 37. Opposite the latter contact-plate is a corresponding plate 38, and adapted to make contact with said contact-plates is a switch-arm 39, carried on the core 40 of a solenoid 41 or on the armature of a corresponding magnet. When the core 41 is attracted by said solenoid 40, the switch-arm 39 will be elevated so as to complete the circuit between the plates 37 and 38; but when said solenoid is deënergized a spring 42 forces the switch-arm 39 into contact with two contact-plates 43 and 44, the purpose of which will be presently explained.

45 is a wire connecting the contact-plate 38 with a contact-plate 46, and 47 is a corresponding contact-plate opposite to the latter contact-plate 46.

48 is a switch-arm carried on the core 49 of

a solenoid 50 and adapted when said solenoid is deënergized to be forced by means of the spring 51 into contact with the plates 46 and 47, so as to make contact between said plates. When said solenoid 50 is energized, the said switch-arm 48 is moved into contact with the two contact-plates 52 53, the purpose of which will be presently explained.

54 is a wire connecting the plates 24 and 27 together, and 55 is a wire connecting both of said plates with the contact-piece 47.

56 is a wire connecting the extreme upper plate 17 of the series of contact-plates above the switch-arm 12 with the plate 53, and 57 is a wire connecting contact-plate 52 with the plate 44. The other contact-plate 43 is connected by a wire 58 with a very powerful solenoid 59, which is connected by a wire 60 with the supply-main 33.

The core 61 of the solenoid 59 connects with a lever 62, carrying a brake-shoe 63 or analogous element at its free end and adapted to be drawn into contact with a face-wheel 64, carried on the motor-shaft, so as to brake the same.

65 is a wire connecting the end of the wire 22 with a contact-plate 66, and 67 is another contact-plate opposite the same and with which a switch-arm 68 is adapted to make contact. Said switch-arm is carried on the end of the core 69 of the solenoid 70, which is normally deënergized, and 71 is a spring for forcing said switch-arm in contact with said contact-plates when the circuit to said solenoid is broken.

72 is a wire connecting the plate 67 with the field 73 of the motor 3, the other side of said field being connected by a wire 74 with the supply-main 33.

75 75 are circuit breakers or closers carried on the various landings of the building and adapted to be operated when the several landing-doors are either closed or are actually fastened, said devices being of any suitable construction, such, for example, as I have shown in applications for Letters Patent filed on even date herewith and will hereinafter describe. These circuit closers or breakers are included in a circuit 76 with a battery or other source of supply 77 and the solenoid 41, so that when all of the circuit closers or breakers are in such condition as indicates that all the landing-doors are closed or fastened the said solenoid or magnet will be energized or deënergized, according to the circuit being a closed or open circuit, to thereby complete the circuit through the brake-solenoid 59 or through the motor-armature, as will be explained.

78 represents a circuit closer or breaker carried on the elevator-car and operated by the closing or fastening of the elevator-door, said circuit closer or breaker being included in the circuit 79 with the battery 80 or other source of supply and the solenoid or magnet 50.

In the present instance I have shown the circuit 76 as being a normally closed circuit and the circuit 79 as being a normally open circuit, the parts therefore, being in the position shown, indicating that the circuit 76 is broken and that therefore one or more of the landing-doors is either open or not properly secured and that the circuit 79 is closed, so as to indicate that the elevator-door is in a similar condition. The parts being in these positions, therefore, the elevator is presumed to be at rest, it being noted that the switch-arm 12 occupies a horizontal position and being out of contact with all of the various contact-plates. Current therefore passes from the main 23 by wires 21 and 56 to contact-plate 53, through switch-arm 48 to contact-plate 52, through wire 57 to contact-plate 44, through switch-arm 39 to contact-plate 43, through wire 58, through solenoid 59, and through wire 60 to the main 33. In this condition, therefore, the solenoid 59 will be energized, attracting the core 61 and forcing the brake-shoe 63 into contact with the face-wheel 64, so as to brake the motor. In this condition it will also be impossible to start the motor, since the armature-circuit thereof is broken at the points 37 38 and 46 47. When, however, all of the landing-doors are closed, so as to complete the circuit 76 and energize the solenoid 41, so as to attract the core 40, the switch-arm 39 will be elevated and will make contact with the plates 37 and 38. This movement, however, it will be noted, does not entirely complete the armature-circuit of the motor, because that circuit is still broken at the points 46 47. It is therefore necessary to close or to fasten the door of the elevator-car, which in this instance breaks the circuit 79, deënergizes the solenoid or magnet 50, and allows the spring 51 to force the switch-arm 48 into contact with the contact-plates 46 and 47. In this condition the motor can be operated as follows:

As stated, the solenoid 70 is in a normally open circuit, as 81, fed from the battery 80 or other source of supply, and having therein a switch 82, which may be located in the car, and by which said circuit may be closed to energize said solenoid 70. It is the intention, however, with the apparatus shown, to maintain the current constantly in the field of the motor, so that said circuit 81 is constantly opened to allow the spring 71 to keep the switch-arm 68 in contact with contact-plates 67 and 68. Current thereby passes through the field of the motor from the main 23, through wires 22 and 65, contact-plate 66, switch-arm 68, contact-plate 67, wire 72, motor-field 73, and wire 74 to the other main 33.

If, for example, it is desired to run the elevator down, the operating-rope 13 is elevated, bringing the portion 15 of the switch-arm into contact with the plate 24 and the lower plate 17 of the series and bringing the portion 14 of said switch-arm into contact with the plates 28 and 29. Current therefore passes through the armature of the motor from the main 23, wire 21, to the first plate 17, resistance 18, to

the second plate 17, second resistance 18, to the third plate 17, to the portion 15 of the switch-arm, to the plate 24, wire 54, plate 47, switch-arm 48, plate 46, wire 45, plate 38, switch-arm 39, plate 37, wire 36, through the armature of the motor, wire 34, to plate 29, through the portion 14 of the switch-arm, to plate 28, wires 31 and 32, to the other main 33 of the circuit. As said controlling-rope 13 is elevated to a greater extent the resistances 18 are cut out of the armature-circuit, and the speed of the motor is thereby accelerated. By moving said controlling-rope in the opposite direction the position of the switch-arm 12 will be reversed, so that the current will be passed through the armature of the motor in the opposite direction, as will be understood, the direction of rotation being reversed.

Having reference to Fig. 2, I illustrate mechanism whereby the controlling-switch for the elevator may be carried on the car instead of being located at the bottom of the elevator-shaft, as explained, and wherein some different features from those above described are introduced. In this form of apparatus the motor 3 controls the elevator-car in the ordinary way. Mounted on the car is a reversing-switch and rheostat 83. While the elements of this switch correspond closely to the corresponding elements of the apparatus shown in Fig. 1, for the purpose of clearness I will designate them by individual numerals.

84 represents a switch-arm made, as before, of three sections insulated from each other, the upper section 85 having a handle to be grasped by the operator. This switch-arm makes contact at each side with a series of contact-plates 86, the plates of which series are connected together by suitable resistances 87, and the outer plates of both series being connected together by a wire 88. Said wire 88 connects by a wire 89 with a contact-plate 90. 91 is another contact-plate opposite the same, which connects by wires 92 and 93 with one of the supply-mains of the electric-light supply of the building or other source of electric supply.

95 is a switch-arm adapted to make contact between the plates 90 and 91, said switch-arm being carried on the end of the core 96 of the solenoid 97. 98 is a spring forcing said switch-arm 95 out of contact with said contact-plates 90 and 91 into contact with contact-plates 98' and 99 when said solenoid 97 is deënergized or is energized, according to the character of circuit with which it is used, whether open or closed.

Beneath the contact-plates 86 are plates 100 and 101, adapted to be engaged by the upper section of the switch-arm 84, and on the other side of the pivotal point of each switch-arm at the right and left thereof are plates 102, 103, 104, and 105. The plates 103 and 105 are connected by a wire 106 to the other side 107 of the source of supply. The plates 101 and 102 are connected by a wire 108 with one brush 109 of the motor 3, and the plates 100 and 104 are connected by a wire 110 with the other brush 111 of said motor.

112 is a brake-solenoid carried adjacent to the motor and connected by a wire 113 with the wire 93 and by a wire 114 with the contact-plate 99. The contact-plate 98 connects by means of the wire 115 with the wire 106.

The core 116 of the solenoid 112 connects with a lever 117, pivoted at 118 to a suitable framework, and the free end of said lever works upon the end of the brake-lever 119, which carries a brake-shoe 120, said brake-shoe engaging with a face-wheel 121, carried on the motor-shaft.

122 122 are circuit closers or breakers on the several landings of the building, adapted to be opened or closed, according to the character of the circuit, by the closing or by the fastening of the several landing-doors. Said contact closers or breakers are included in the circuit 123 with a battery or other source of supply 124 and the solenoid 97. In the present instance the circuit 123 is normally closed, so as to energize said solenoid 97, attracting its core 96 and bringing the switch-arm 95 into contact with the contact 90 and 91. In Fig. 4 said circuit 123 is shown as being broken, indicating thereby that one or more of the landing-doors is either opened or unfastened.

125 is a switch carried in the elevator-car and included in a circuit 126, which short-circuits the circuit closers or breakers 122, so that by closing said circuit 126 the said circuit-breakers will be short-circuited and the solenoid 97 will be constantly energized.

The parts being in the position illustrated in Fig. 4 indicate that one or more of the doors are opened or unfastened, and it will be noted that current will flow from the supply-main 94 directly through the brake-solenoid 112, wire 114, contact 99, switch-arm 95, contact-plate 98, wire 115, to the other side 107 of the supply-circuit, thereby attracting core 116, operating lever 117, and forcing the brake-shoe 120 into contact with the brake-wheel 121, so as to brake the motor. At the same time it will be noted that it will be impossible to start the motor, for the reason that the circuit through the armature thereof is broken at the points 90 and 91. When, however, the circuit 123 is closed, indicating that all the landing-doors are secured, or when the circuit 126 is closed so as to short-circuit the former, the solenoid 97 will be energized, attracting the core 96 and bringing the switch-arm 95 into contact with the contact-plates 90 and 91. If now the controlling-lever 84 is moved to one side or the other—for instance, to the right—current to the armature of the motor traverses the same as follows: from the supply-main 94, wires 93 92, contact-plate 91, switch-arm 95, contact-plate 90, wires 89 and 88, through one of the series of contact-plates 86 and resistances 87 to the upper plate of the switch-arm 84, to plate 101, wire 108, brush 109, motor-armature, brush 111,

wire 110, plate 104, through the lower portion of the switch-arm, plate 103, and wire 106 to the other side 107 of the supply-circuit. It will therefore be seen that if the circuit 123 is closed, indicating that all of the landing-doors are closed and therefore in a safe condition, the motor is free to be controlled from the car by means of the operating-lever 84.

In carrying out my invention in practice I prefer to use switches in the motor-circuit, which in this instance will be operated by the solenoids 41 and 50 and which should be of such a construction that the current to the motor will be introduced gradually thereto under all conditions, and I illustrate the particular form of switches in Figs. 3 and 4 solely for the purpose of clearness.

It will be seen that if the switch-arm 12 is moved in either direction to its extreme limit and any one of the safety-circuits is broken, so as to break the motor-circuit, when said safety-circuit is again completed there will (in the apparatus of Figs. 1 and 2) be no resistances in the motor-circuit, so that there will be danger of burning the motor out. This danger will also be appreciated when it is remembered that the operator is liable to operate the controlling-switch 12 before he has closed the elevator-door or landing-door, in which case the same danger arises when the safety-circuit is then completed. It is for this reason, therefore, that I prefer to employ switches controlled in this instance by the solenoids 41 and 50, which will introduce the current gradually into the motor, and in Fig. 3 I illustrate diagrammatically a switch embodying these ideas. Having reference to this figure, I illustrate a solenoid 41, which is horizontally arranged and wherein the core 42 connects with a switch-arm 127, mounted at 128, the upper portion of which is insulated at 129. 130 is a spring normally holding the switch 127 against a stop 131. 132 132 are contact-plates connected by resistances 133, and 134 is a contact-plate arranged beneath the plates 132. The wires 135 and 136 connect with the contact-plate 134 and with the end plate 133. With this form of switch it will be seen that when the safety-circuit is closed, energizing the solenoid 41 and thereby attracting the core 42 thereof, the switch-arm 127 will be moved toward a stop 137 and in this movement will gradually cut out of the motor-circuit the several resistances 133, so that the current of the motor will be introduced gradually therein and thereby entirely prevent the possibility of the armature being burned out.

In Figs. 4, 5, and 6 I show a convenient form of circuit making and breaking device which may be used in this system, but to which I do not make a claim, as the same is covered in my concurrent application, filed April 4, 1896, Serial No. 586,213. This making and breaking device will be briefly described.

138 is a heavy insulating-plate secured to the ironwork of the building, and 139 is the casing of the lock of a landing-door secured to said plate, so as to be effectively insulated from the ironwork of the building.

140 is a heavy insulating-block mounted within the casing 139 and carrying two contact-springs 141 141, to which the wires of the safety-circuit are connected in the usual way. 142 is a metal plate adapted to make contact with the springs 141, so as to close the safety-circuit. The said plate is carried by the sleeve 143, which is fixed in the insulating-block 144. Said insulating-block is carried in a frame 145, having outturned ways 146, which engage with light guide-bars 147, so that said frame will be guided vertically.

In order to keep the contact-springs 141 normally out of contact with the plate 142, I make use of a spring 149, bearing beneath said plate and surrounding a guide-rod 148, which is embedded in the insulating-block 140 and works within the sleeve 143.

By means of a circuit closer and breaker of this character it will be seen that when the latch of a landing-door enters the opening at the upper end of the casing 139 the weight thereof resting upon the frame 145 will move the contact-plate 142 downwardly, so as to complete the circuit between the springs 141, and that when said latch is removed the spring 149 will elevate the contact-plate 142, so as to break the circuit.

Having now described my invention, what I claim as new therein, and desire to secure by Letters Patent, is as follows:

1. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, a switch controlling the circuit to said motor, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, and a closer or breaker in said safety-circuit controlled by a door opening on the elevator-shaft, substantially as set forth.

2. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, a switch controlling the circuit of said motor, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, and a series of closers or breakers in said safety-circuit controlled by the landing-door, substantially as set forth.

3. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, two switches controlling the circuit of said motor, a solenoid or magnet for operating each of said switches, a safety-circuit including one of said solenoids or magnets, a series of closers or breakers in said safety-circuit controlled by the landing-door, a safety-circuit including the other of said solenoids or magnets, and a closer or breaker in the latter circuit controlled by the car-door, substantially as set forth.

4. In an electric elevator, the combination

of an elevator car or cage, an electric motor for operating the same, a switch controlling the circuit of said motor, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, a closer or breaker in said safety-circuit controlled by a door opening on the elevator-shaft, and a brake for said motor, operated by said switch when the same is moved to break the motor-circuit, substantially as set forth.

5. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, a switch controlling the motor to said circuit, a brake-shoe for said motor, a solenoid or magnet for operating said brake-shoe, a circuit for said solenoid or magnet also controlled by said switch when the latter is moved to break the motor-circuit, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, and a closer or breaker in said safety device, controlled by a door opening on the elevator-shaft, substantially as set forth.

6. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, two switches controlling the circuit to said motor, a brake-shoe for said motor, a solenoid or magnet for operating said brake-shoe, a circuit for said solenoid or magnet controlled by said switches when the same are moved to break the motor-circuit, a solenoid or magnet for operating each of said switches, a safety-circuit including one of said solenoids or magnets, a series of closers or breakers in said safety-circuit controlled by the landing-door, a safety-circuit for the other of said solenoids or magnets, and a closer or breaker in the latter circuit controlled by a car-door, substantially as set forth.

7. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, a switch controlling the armature-circuit to said motor, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, a closer or breaker in said safety-circuit controlled by a door opening on the elevator-shaft, a switch in the field-circuit of the motor, a solenoid or magnet for operating said switch, and a switch in the car for controlling said solenoid or magnet, substantially as set forth.

8. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, a switch controlling the circuit to said motor, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, and a closer or breaker in said safety-circuit controlled by the latch of a door opening upon the elevator-door, substantially as set forth.

9. In an electric elevator, the combination of an elevator car or cage, an electric motor for operating the same, a switch controlling the circuit to said motor, a solenoid or magnet for operating said switch, a safety-circuit including said solenoid or magnet, and a series of closers or breakers in said safety-circuit controlled by the latches of the landing-doors, substantially as set forth.

This specification signed and witnessed this 12th day of March, 1896.

SAMUEL D. STROHM.

Witnesses:
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(No Model.) 2 Sheets—Sheet 1.

J. S. MUCKLÉ.

ELEVATOR MECHANISM.

No. 579,072. Patented Mar. 16, 1897.

FIG. 1.

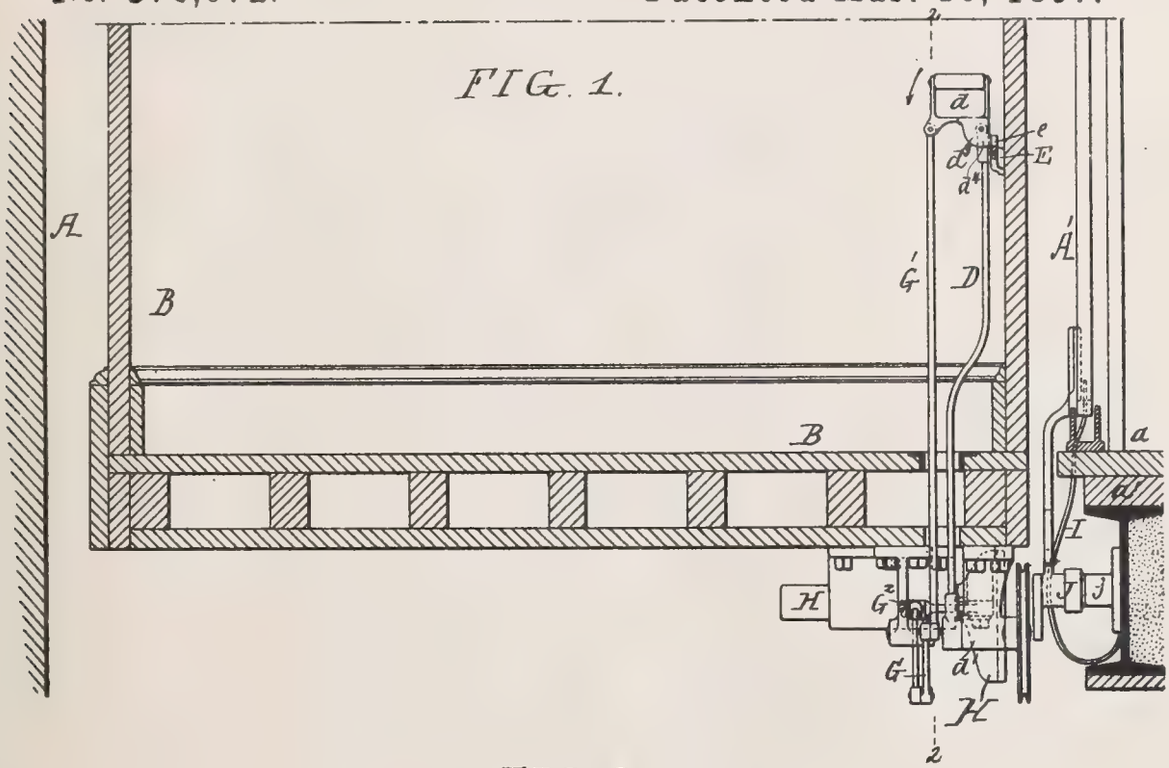
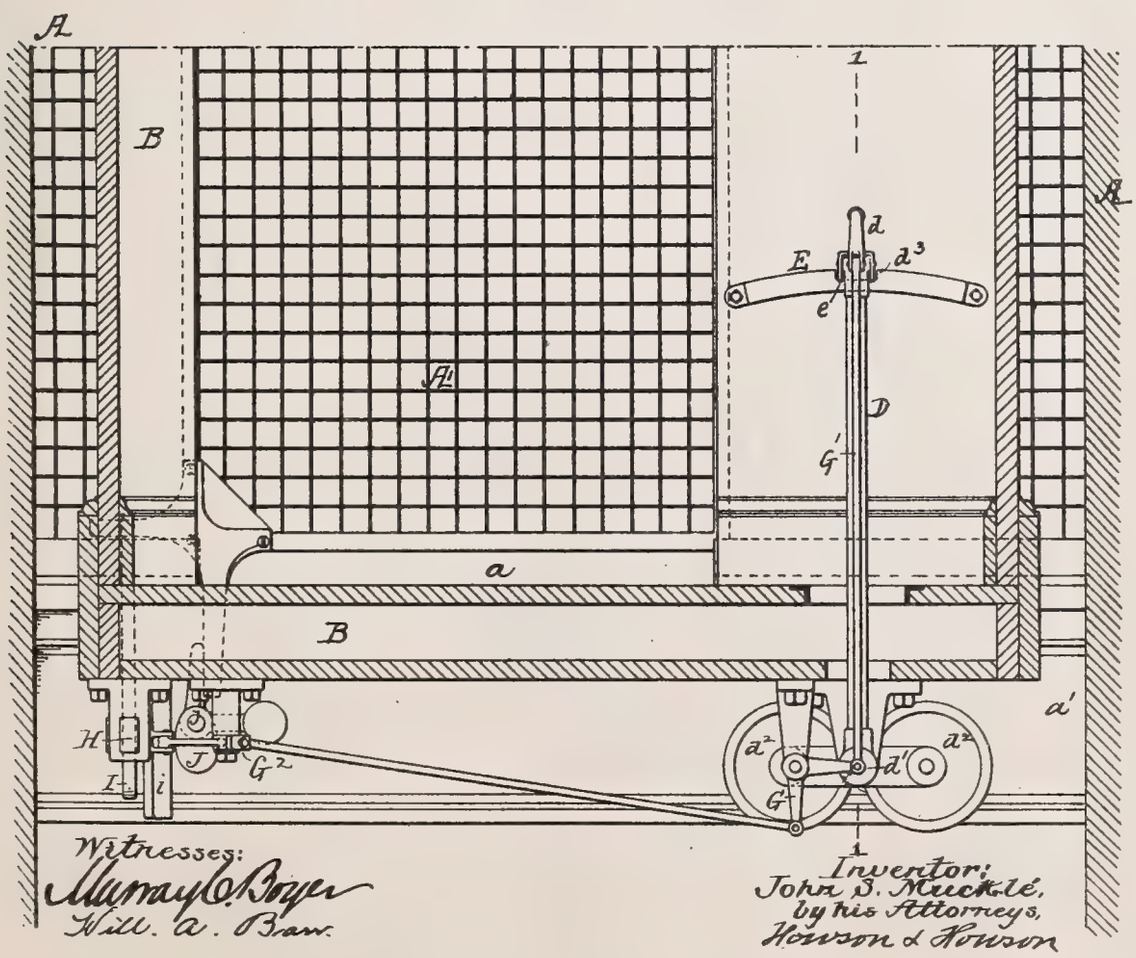


FIG. 2.



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Inventor:
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THE NORRIS PETERS CO., PHOTO-LITHO WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

J. S. MUCKLÉ.

ELEVATOR MECHANISM.

No. 579,072. Patented Mar. 16, 1897.

FIG. 3.

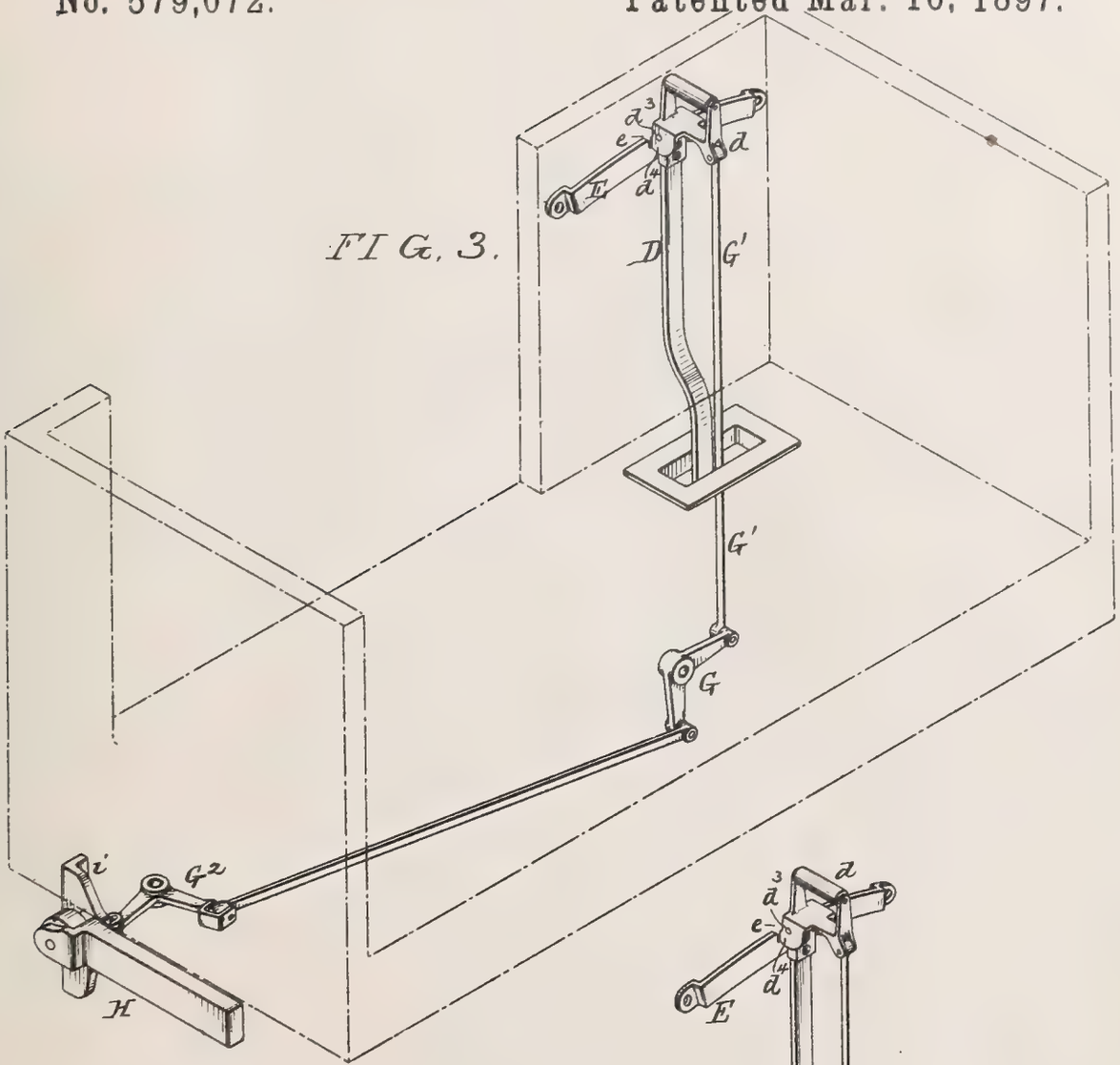


FIG. 4.

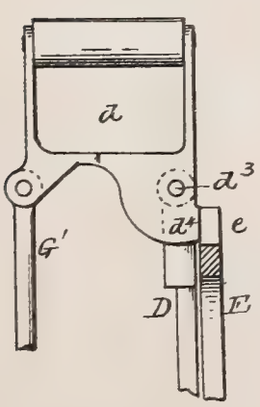
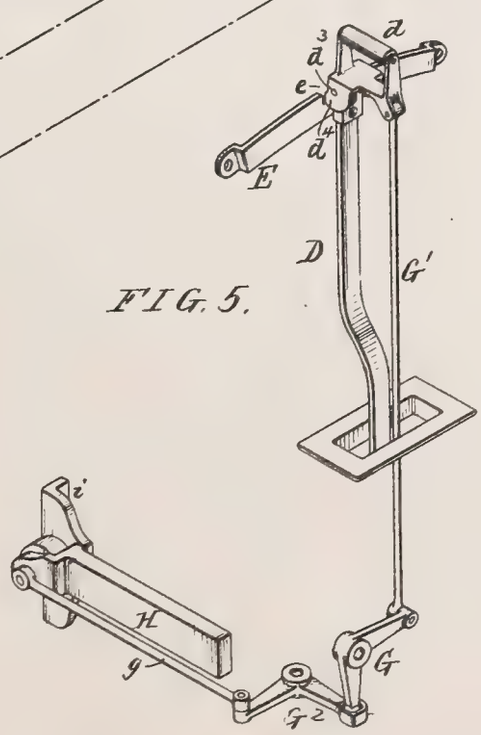


FIG. 5.



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UNITED STATES PATENT OFFICE.

JOHN S. MUCKLÉ, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO M. R. MUCKLÉ, JR., & CO., OF SAME PLACE.

ELEVATOR MECHANISM.

SPECIFICATION forming part of Letters Patent No. 579,072, dated March 16, 1897.

Application filed December 31, 1896. Serial No. 617,640. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. MUCKLÉ, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Elevator Mechanism, of which the following is a specification.

The object of my invention is to provide means for locking the landing-doors of elevator-wells when the operating mechanism is free and to lock the said mechanism when one of the doors is open.

My invention is especially adapted for use in connection with elevator-cars having lever mechanism for stopping and starting in lieu of either wheels or ropes or rods passing through the car.

In the accompanying drawings, Figure 1 is a vertical sectional view of an elevator car and well on the line 1 1, Fig. 2. Fig. 2 is a vertical sectional view on the line 2 2, Fig. 1. Fig. 3 is a perspective diagram. Fig. 4 is an enlarged view of one end of the hand-lever, and Fig. 5 is a diagram view of a modification.

A are the walls of an elevator-well having doorways *a* for the different landing-floors *a'*.

B is an elevator-car.

D is a hand-lever having a handhold *d*, and this lever is pivoted at *d'* to the car and in the present instance has two wheels d^2, around which passes the rope or chain connected to the controlling mechanism in the well, so that when the lever is moved to a central position the car will remain stationary and when moved to one side of the center the mechanism will be so shifted that the elevating mechanism will lift the car and when moved to the opposite side of the same the mechanism will be so shifted as to allow the car to descend.

I pivot the handhold *d* at d^3 to the lever D, so that it will have a motion in the direction of the arrow, Fig. 1. At the rear of the handle is a lug d^4, which may enter a notch *e* in a segment E, secured to the car, when the operator moves the lever to the center position to stop the car.

The pivoted handhold *d* is connected to a lever G by a rod G'. This lever G is pivoted to bearings on the under side of the car and its other arm is connected to an arm of a lever G^2, arranged on a vertical pivot, and an arm of this lever is connected to the locking-slide H, which is mounted in bearings on the under side of the car and on its outward movement presses against a spring-catch I, which locks the door A' in its closed position. The further movement of the slide H releases the door, so that the operator can open it. On the slide is a flange *i*, with which engages a locking-lever J, hung at *j* to the side of the elevator-well. One arm of this lever is controlled by the door, while the other arm is weighted.

The moment the door is released and opened by the operator after bringing the car to a stop the locking-lever is free and swings in front of the flange *i* of the slide H, preventing the slide from being operated until the door is again closed. On the closing of the door a projection thereon strikes the locking-lever J, moves it away from the slide, so that the slide is released, and the operator can then move the handhold clear of the notch, and the lever can then be moved in either direction.

It will be seen that the car cannot move when the elevator-door is open and the door cannot be operated except when the elevator-car is at the landing and at rest, so that the operator can release the door by the movement of the mechanism described above.

In Fig. 5 I have shown a slight modification in which the levers G G^2 are directly connected and the lever G^2 connected to the slide by a rod *g*. It will be understood that the arrangement of parts can be modified to accord with different elevator constructions.

I claim as my invention—

1. The combination of an elevator-car, a lever connected to controlling mechanism, a portion of said lever being independently movable, door-releasing means on the car connected to the independently-movable portion of the lever, a landing-door, and catch therefor adapted to be operated by the releasing means on the car, substantially as described.

2. The combination of an elevator-car, a landing-door, a slide, a pivoted controlling-lever mounted on the car, having a pivoted handhold connected to the slide, a notched segment fixed in the car, the pivoted handhold having a lug adapted to a notch in the

segment, so that the lever must be opposite the notch in the segment before the slide can be operated to release the door, and means for locking the handhold to the segment while the door is open, substantially as described.

3. The combination of the elevator-well, the door, an elevator-car, a pivoted lever D connected to the controlling mechanism, and having a pivoted handhold *d*, a bell-crank lever G on a horizontal pivot, a rod connecting the bell-crank lever with the handhold *d*, a second bell-crank lever G^2 arranged on a vertical pivot and connected to the bell-crank lever G, a slide H connected to the said lever G^2, a notched segment fixed in the car, the pivoted handhold *d* having a lug adapted to rest in the notch of the segment so that the lever cannot be moved in either direction until the handhold is turned on its pivot, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN S. MUCKLE.

Witnesses:
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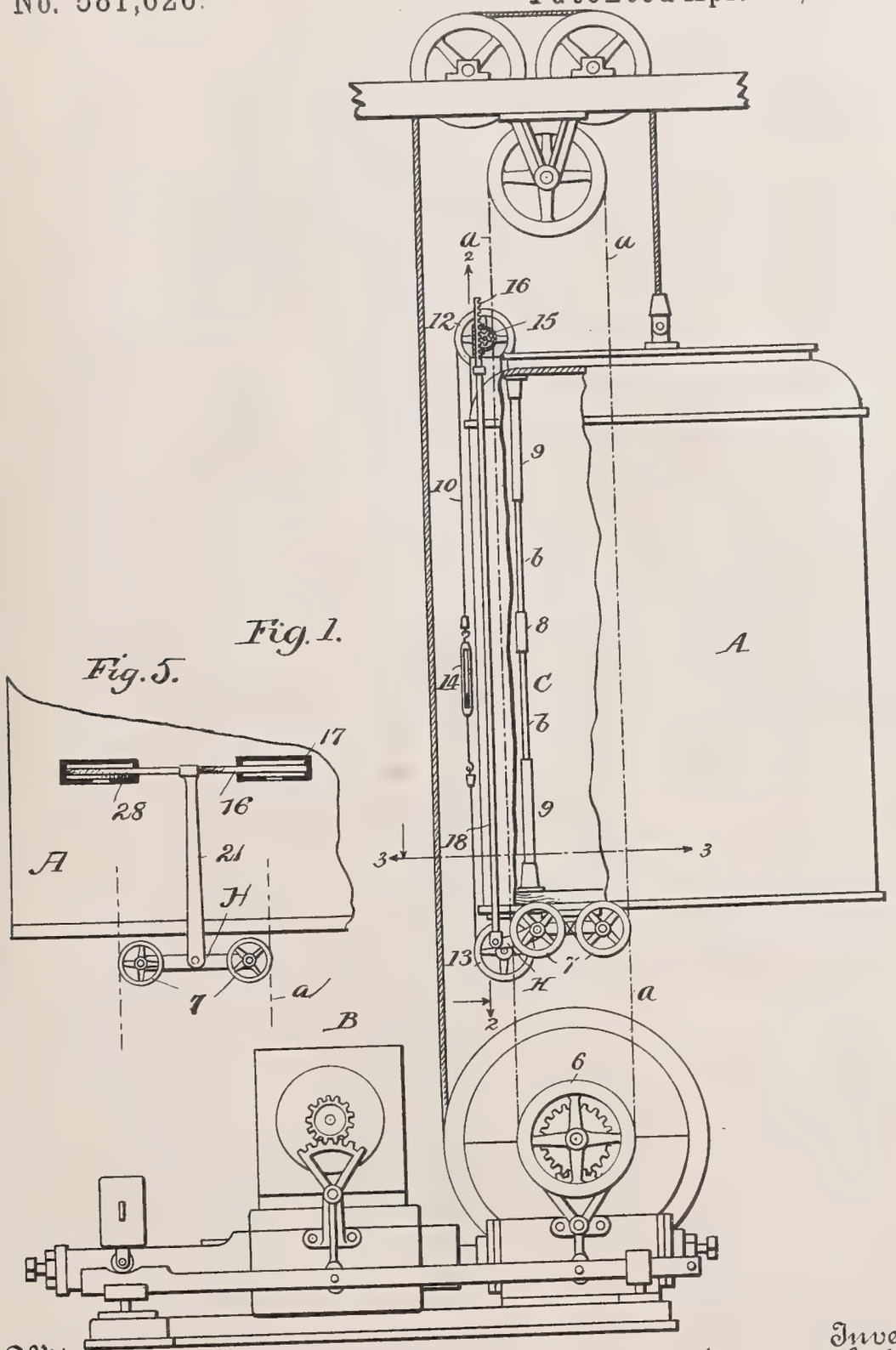
(No Model.) 2 Sheets—Sheet 1.

R. C. SMITH.

MEANS FOR OPERATING CONTROL DEVICES OF ELEVATORS.

No. 581,626. Patented Apr. 27, 1897.



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5-81516

(No Model.) 2 Sheets—Sheet 2.

R. C. SMITH.

MEANS FOR OPERATING CONTROL DEVICES OF ELEVATORS.

No. 581,626. Patented Apr. 27, 1897.

Fig. 2.

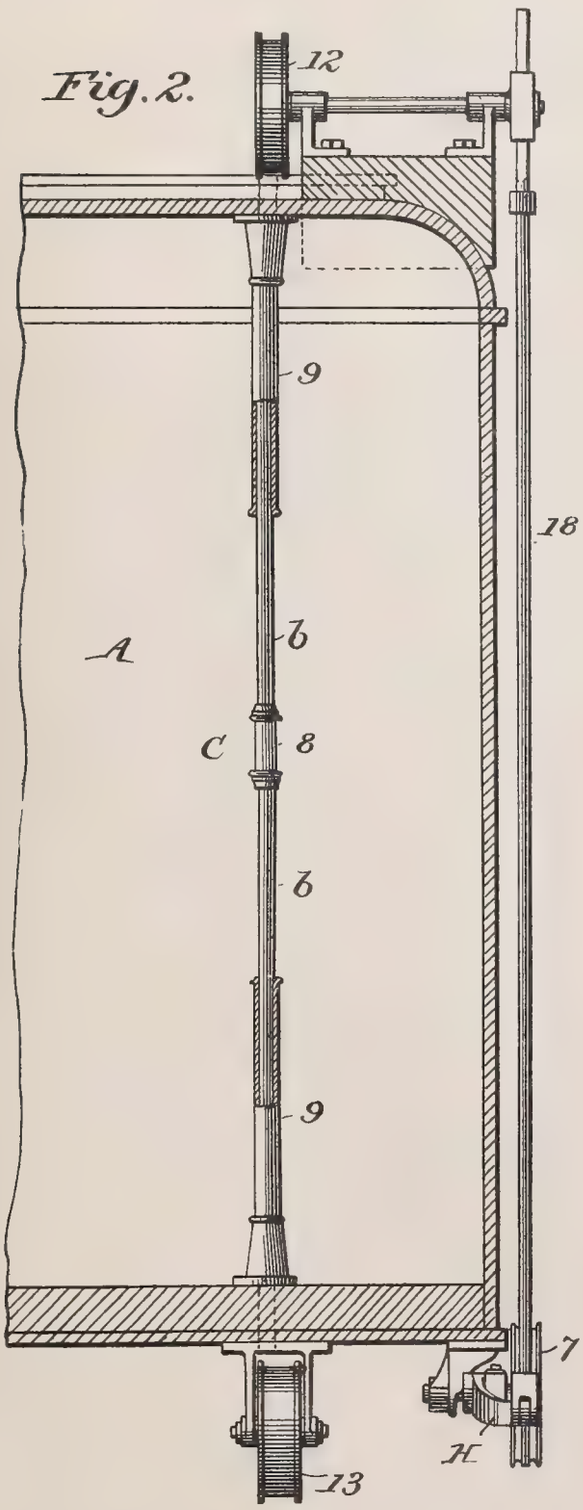


Fig. 3.

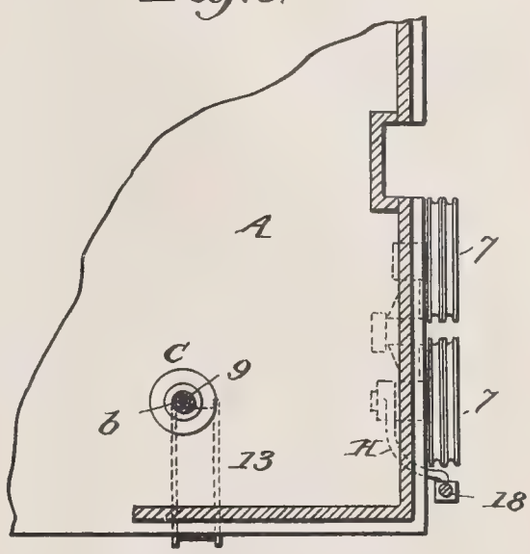
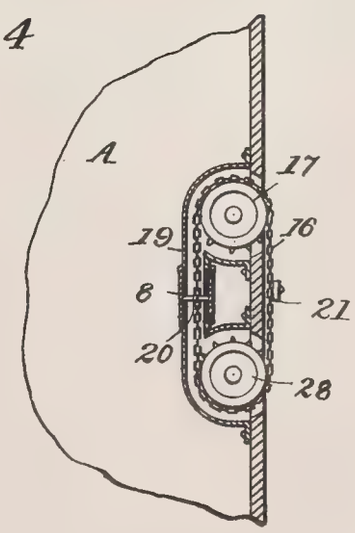


Fig. 4.



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UNITED STATES PATENT OFFICE.

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MEANS FOR OPERATING CONTROL DEVICES OF ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 581,626, dated April 27, 1897.

Application filed February 27, 1895. Serial No. 539,936. (No model.)

To all whom it may concern:

Be it known that I, RUDOLPH C. SMITH, a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Means for Operating the Control Devices of Elevators, of which the following is a specification.

In those elevator apparatus in which it has been necessary or desirable to make use of a hand gear or device within the cage to operate the cables connected with the stopping and starting device such hand-gear has consisted of vertical or horizontal levers or hand-wheels having handles projecting therefrom, or of other constructions of such a character that the clothing of persons passing to or from the elevator-car is liable to engage with the device or some part thereof and shift the same and the valve or other part connected therewith, starting the cage in motion with risk of danger to the occupants. So long as any hand operating device is used having a projecting handle or grasp extending at an angle to its line of movement and capable of engaging the clothing or of contact with the person, so as to be shifted by the drag of the clothing or the pressure of the person, such accidents cannot be prevented. In order to overcome these defects, I make use of an operating device in which the hand-gear is provided with a bar or rod which may be grasped within the hand and which is arranged longitudinal to its line of movement, as fully set forth hereinafter and as illustrated in the accompanying drawings, in which—

Figure 1 is a sectional elevation of an elevator apparatus having a control device embodying my improvement. Fig. 2 is a section on the line 2 2, Fig. 1. Fig. 3 is a sectional plan on the line 3 3, Fig. 1. Fig. 4 is a sectional view showing a modification. Fig. 5 is a detail side elevation of the modification illustrated in Fig. 4.

A represents the cage or car of the elevator, and B the stopping and starting or controlling device, which may be a water or steam valve or electric switch, or any of the usual devices employed for such purposes, and which is operated from the cage through the medium of one or more running or stationary cables by taking up or elongating bights in such cables. As shown, there are two standing cables *a a*, connected with a pulley 6, the rotation of which shifts the stopping and starting or control device B, the said cables passing around pulleys 7 7, carried by a lever H, pivoted to the cage and operating to take up or elongate bights in the cables, as set forth in Letters Patent to N. C. Bassett, No. 453,955. Any other form of cable operating devices may, however, be employed—as, for instance, the single traveling cable shown in C. W. Baldwin's patent, No, 548,107, or G. H. Reynolds's patent, No. 456,152.

As shown, the operating device C consists of a tubular or solid rod or tube *b*, having a hand-grasp 8 at the center and guided so as to move in the line of the direction of its length or longitudinal axis—as, for instance, extending into tubes 9 9, bolted to the ceiling and floor of the car—and between the hand-operated device and the cable-controlled devices are any suitable intermediate connections whereby the longitudinal movement of the hand-grasp 8 will shift the cable-controlled devices, and with them the stopping and starting devices.

In most instances with large elevator apparatus of the modern type with cars traveling at a high rate of speed it would be impracticable to connect the hand-operated device directly with the cable-controlled devices, and it is preferable to make use of intermediate connections that will give the operator the advantage of a leverage in operation with the cable-controlled devices. Different intermediate connections may be employed, but I prefer that shown, consisting of a cable 10, connected to the ends of the bar *b*, passing over an upper pulley 12 and beneath a lower pulley 13, and provided with a tightening device 14, the shaft of the pulley 12 having a pinion 15 engaging a rack 16 on a rod 18, connected to an arm projecting from the lever H. By this arrangement and proportion of intermediate connections the operator has such a leverage that he can exert all necessary power to operate the cables without any undue exertion in moving the operating device. The arrangement shown has also the further advantage that the move-

ments made by the operator correspond to those made in operating the ordinary hand-rope, so that there is no danger of accident in transferring an operator from an apparatus provided with an ordinary hand-rope to one provided with my improved operating device.

While it is preferable to arrange the hand-operated device to move vertically, my invention may be embodied in a device having a horizontal longitudinal movement. Thus in Fig. 4 the control device consists of an endless cable 16, passing around horizontal guide-pulleys 17 and 18, extending through the side of the car, and provided with a hand-grasp 8, in the form of a sleeve sliding upon a tubular portion of a casing 19, covering the guide-pulleys within the cage, a cross-pin 20 of the hand-grasp extending through slots in the casing and being connected to the cable. Outside of the case the cable is connected to a lever 21, connected in any suitable manner with the cable controlling devices.

Whether the hand-operated device be arranged to move vertically or horizontally, it will be seen that it has a longitudinal movement only, and that it cannot be shifted either by the pressure of persons against it or by engaging with any moving object, except when directly grasped by the hand and moved longitudinally.

Without limiting myself to the precise construction and arrangement of parts shown, I claim as my invention—

1. The combination with the operating-cable device of an elevator, of means for taking up or relaxing the cable, and a hand operating device within the car, guides therefor arranged to permit only a longitudinal vertical movement of said device, and connections between the said hand device and the means for taking up and relaxing the operating-cable, substantially as described.

2. The combination with an elevator-car and with the cable control device for operating the stopping and starting device, and means for taking up and relaxing the cable, of a hand device consisting of a rod or bar within the car supported longitudinally in line with the direction of its movement and connected to operate said means, substantially as set forth.

3. The combination of an elevator-car, cable control devices carried thereby, an operating-rod provided with a rack, a pinion engaging said rack and pulley connected therewith, and a second pulley and cables passing around said pulleys, and into the car and connected with a hand control device therein, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RUDOLPH C. SMITH.

Witnesses:
HENRY L. BRANT,
W. CHARLES EGGERT.

(No Model.) 2 Sheets—Sheet 1.

R. W. HARE.

ELEVATOR LOCK.

No. 581,860. Patented May 4, 1897.

Fig. 1.

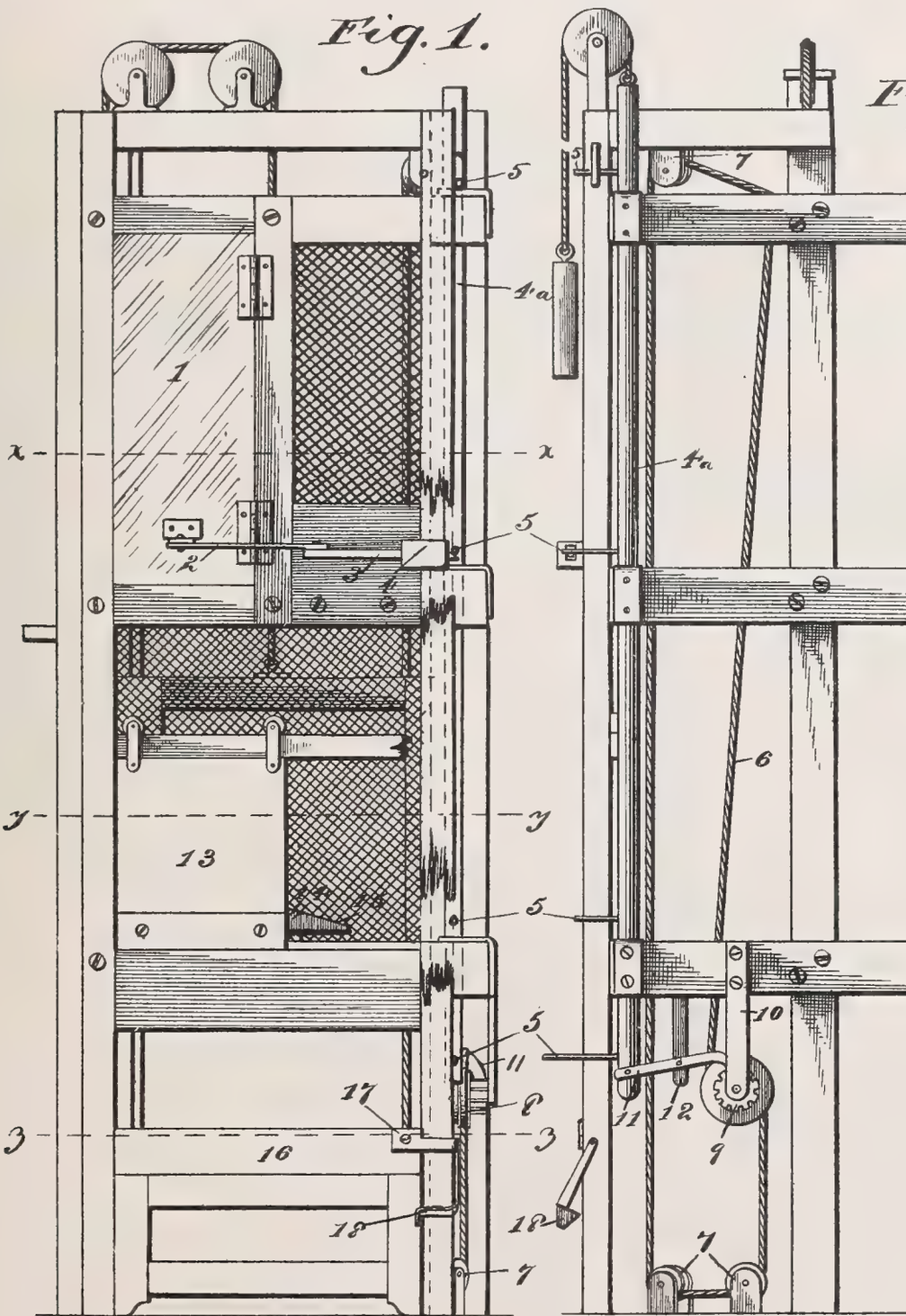
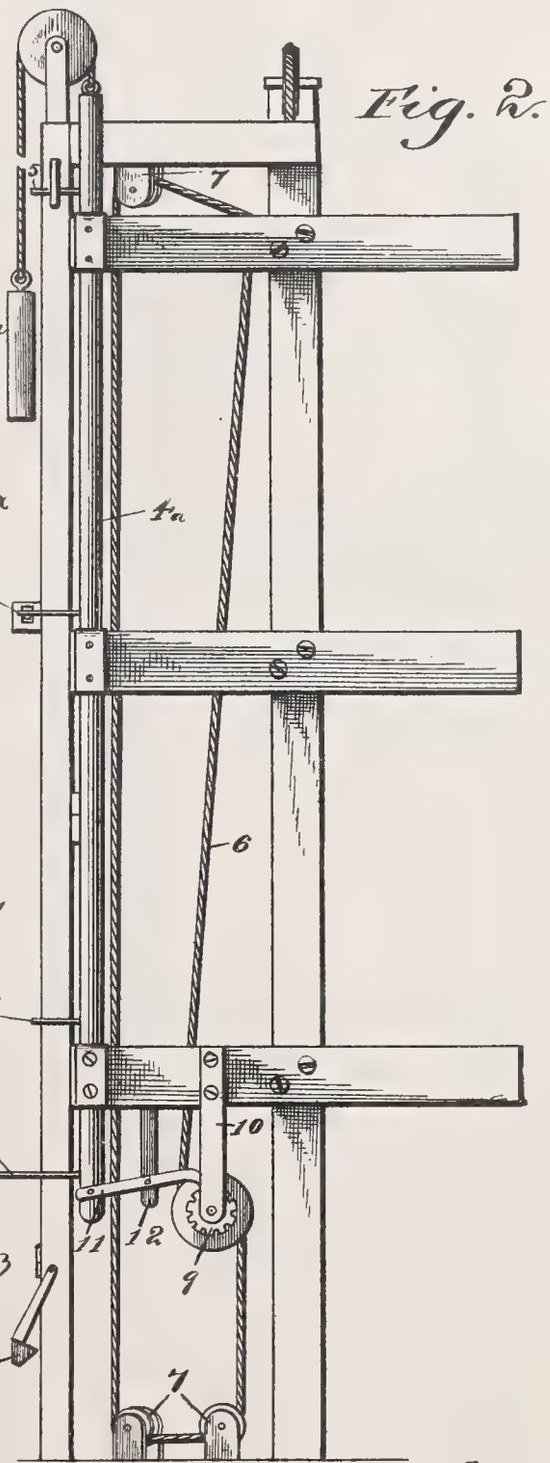


Fig. 2.



Witnesses:
J. B. McGirr.
D. V. Chadwick.

Inventor.
Robert W. Hare
by H. C. Evert
Atty

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

R. W. HARE.

ELEVATOR LOCK.

No. 581,860. Patented May 4, 1897.

Fig. 3.

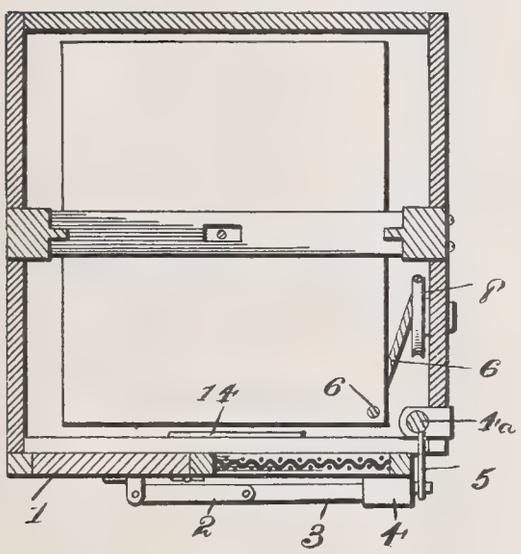


Fig. 4.

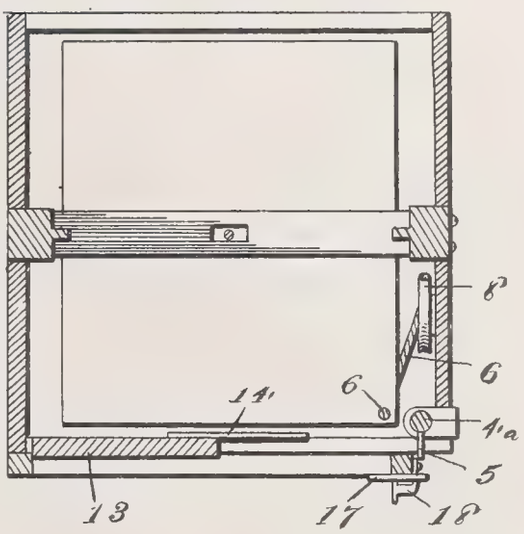


Fig. 5.

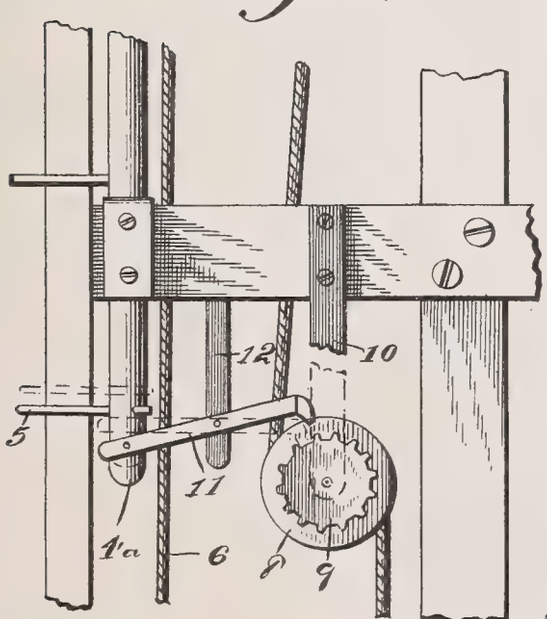
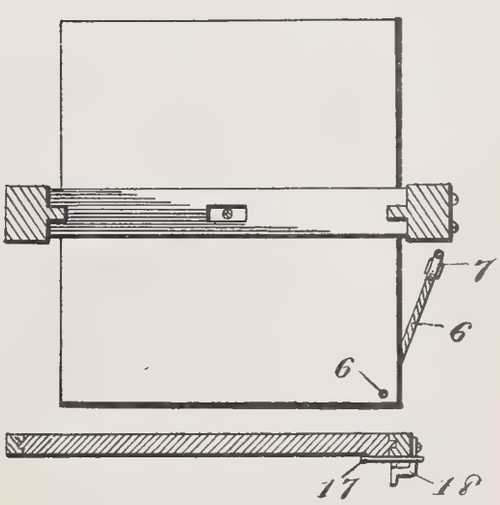


Fig. 6.



Witnesses:
J. B. McGirr.
D. V. Chadwick.

Fig. 7.

Inventor:
Robert W. Hare
by H. C. Evert atty

THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ROBERT W. HARE, OF ALLEGHENY, PENNSYLVANIA

ELEVATOR-LOCK.

SPECIFICATION forming part of Letters Patent No. 581,860, dated May 4, 1897.

Application filed January 7, 1896. Serial No. 574,605. (No model.)

To all whom it may concern:

Be it known that I, ROBERT W. HARE, a citizen of the United States of America, residing at Allegheny, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Elevator-Locks, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in locking devices for elevators, and relates particularly to those that are automatic in their operation.

The invention has for its object the construction of a locking device of the above-referred-to class whereby the elevator-car will be securely locked while the door is open or the gate is raised and cannot be operated until the door is again closed or the gate lowered.

The invention has for its still further object the construction of a locking device for this purpose that will be entirely automatic in its operation, thus requiring no additional mechanism for the operator to handle, and that can be secured in the elevator-shaft without interfering in any manner with the operation of the car or gate.

A still further object of the invention is to provide a locking device of the above-described class that will be extremely simple in its construction, strong, durable, and effectual in its operation, and comparatively inexpensive to manufacture.

With the above and other objects in view the invention finally consists in the novel construction, combination, and arrangement of parts to be hereinafter more particularly described, and specifically pointed out in the claims.

In describing the invention in detail reference is had to the accompanying drawings, forming a part of this specification, and wherein like figures of reference indicate similar parts throughout the several views, in which—

Figure 1 is a front view of an elevator-shaft. Fig. 2 is a side view thereof. Fig. 3 is a sectional view taken on the line $x\,x$ of Fig. 1. Fig. 4 is a view taken on the line $y\,y$ of Fig. 1. Fig. 5 is an enlarged detail view of the hand-line-controlling mechanism, and Fig. 6 is a sectional view taken on the line $z\,z$ of Fig. 1.

In the drawings, 1 denotes a form of door applied at a floor of a building, and to the door is pivoted a link 2, which in turn is pivoted to a slide 3, having a beveled end, said slide 3 being slidable in a casing or bearing 4. A rod 4^a is arranged to slide vertically in the shaft, preferably in one corner thereof, and arms 5 project outwardly therefrom and are adapted to be engaged by the end of the slide 3, whereby the rod is elevated when the door 1 is swung open. When the door is closed, the slide 3 is withdrawn and the weight of the rod causes it to descend to its normal position, as shown in full lines in Fig. 5, while in dotted lines the position of the rod and its arms is shown when the slide 3 is in engagement with either of the arms 5, presuming, of course, that all of the floors have doors similar to that shown at the top.

The hand-line 6 operates over a series of pulleys 7 and a controlling-pulley arranged on the shaft, having a toothed wheel 9, said shaft being suitably hung in a bracket 10.

A lever 11 is pivoted to a support 12 and to the sliding rod. This lever is provided with a toothed end to engage the toothed wheel when the rod 4 is elevated by the arm of the door, such engagement resulting in the locking of the controlling-pulley, which renders the hand-line inoperative during such engagement.

In connection with the hinged door I also illustrate a transversely-slidable door 13, provided with an extension 14, having an inclined edge 15, adapted to engage the arms of the rod to elevate it, as will be apparent. I have also shown a vertically-slidable door 16, having an extension 17, which engages the arms of the slidable rod. The support 18 holds the door 16 suspended.

The construction, as well as the operation and advantages, will be understood from the foregoing description, and it will be noted that various changes may be made in the details of construction without departing from the spirit of my invention.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an elevator the combination of the

controller-rope, floor-doors, slides connected with said doors, a rod extending the length of the elevator-shaft and adapted to be actuated by the slides, a lever connected to said rod, a toothed wheel adapted to be engaged by the lever, said wheel being engaged by said controlling-rope, substantially as described.

2. In an elevator, the combination of the controller-rope, floor-doors, slides connected with said doors a rod extending the length of the elevator-shaft and adapted to be operated by said slides, and connections whereby said controller-rope is locked by the movement of said rod, substantially as described.

3. In an elevator, the combination of the controller-rope, floor-doors, a vertical rod extending the length of the elevator-shaft, connections whereby said rod is moved by the opening of the doors, a lever connected to the rod, a toothed wheel adapted to be engaged by the lever and a pulley on the shaft of the toothed wheel, the controller-rope passing around said pulley, substantially as described.

4. In an elevator the combination of the controller-rope, floor-doors, a vertically-slidable rod extending the length of the elevator-shaft, slides adapted to operate said rod, links connecting said slides and doors, a lever connected with said rod, a toothed wheel adapted to be engaged by said lever, a pulley on the shaft of the toothed wheel, the controller-rope passing around said pulley, substantially as described.

5. In an elevator the combination of the controller-rope, floor-doors, a rod extending the length of the elevator-shaft, means whereby said rod is moved by the opening of any one of the doors, and connections whereby said controller-rope is locked by the movement of said rod, substantially as described.

6. In an elevator-lock, a rod reciprocable in the elevator-shaft said rod being provided with an arm at each floor, the door at each floor having a cam secured thereon adapted to engage the arm and operate the rod, a line and weight attached to the upper end of the rod, a lever connected to said rod at its lower end and provided with cogs and a cog-wheel secured to the motor-controlling sheave and adapted to be engaged by said lever, substantially as shown and described.

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT W. HARE.

Witnesses:
ALFRED M. WILSON,
LOUIS MOESER.

(No Model.) 2 Sheets—Sheet 1.

J. S. MUCKLÉ.

ELEVATOR MECHANISM.

No. 583,331. Patented May 25, 1897.

FIG. 1.

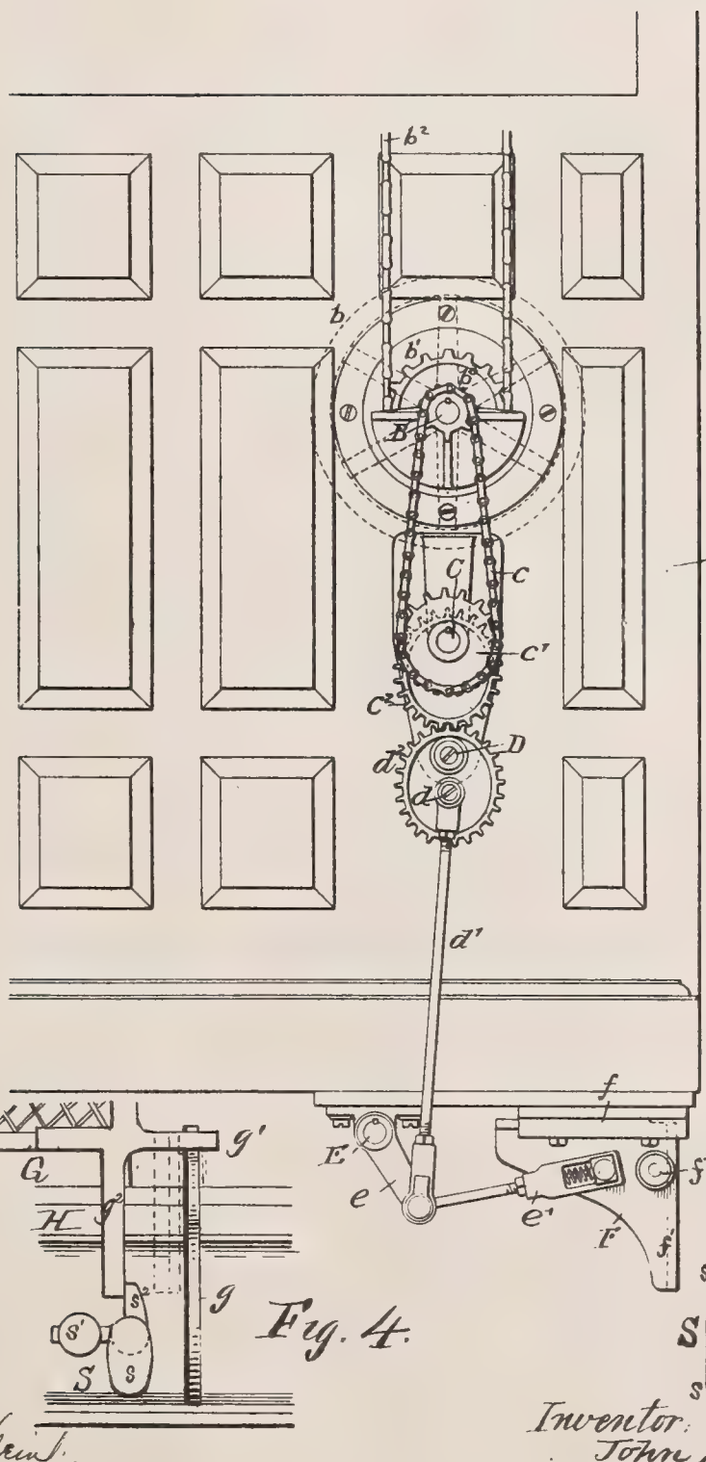
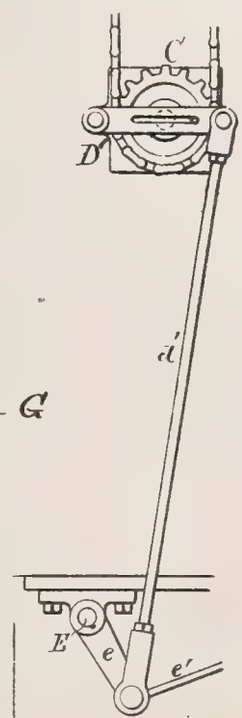


Fig. 4.

FIG. 3.



Witnesses:
Jos. H. Kent
Harry Smith

Inventor:
John S. Muckle
by his Attorneys Howson & Howson

THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

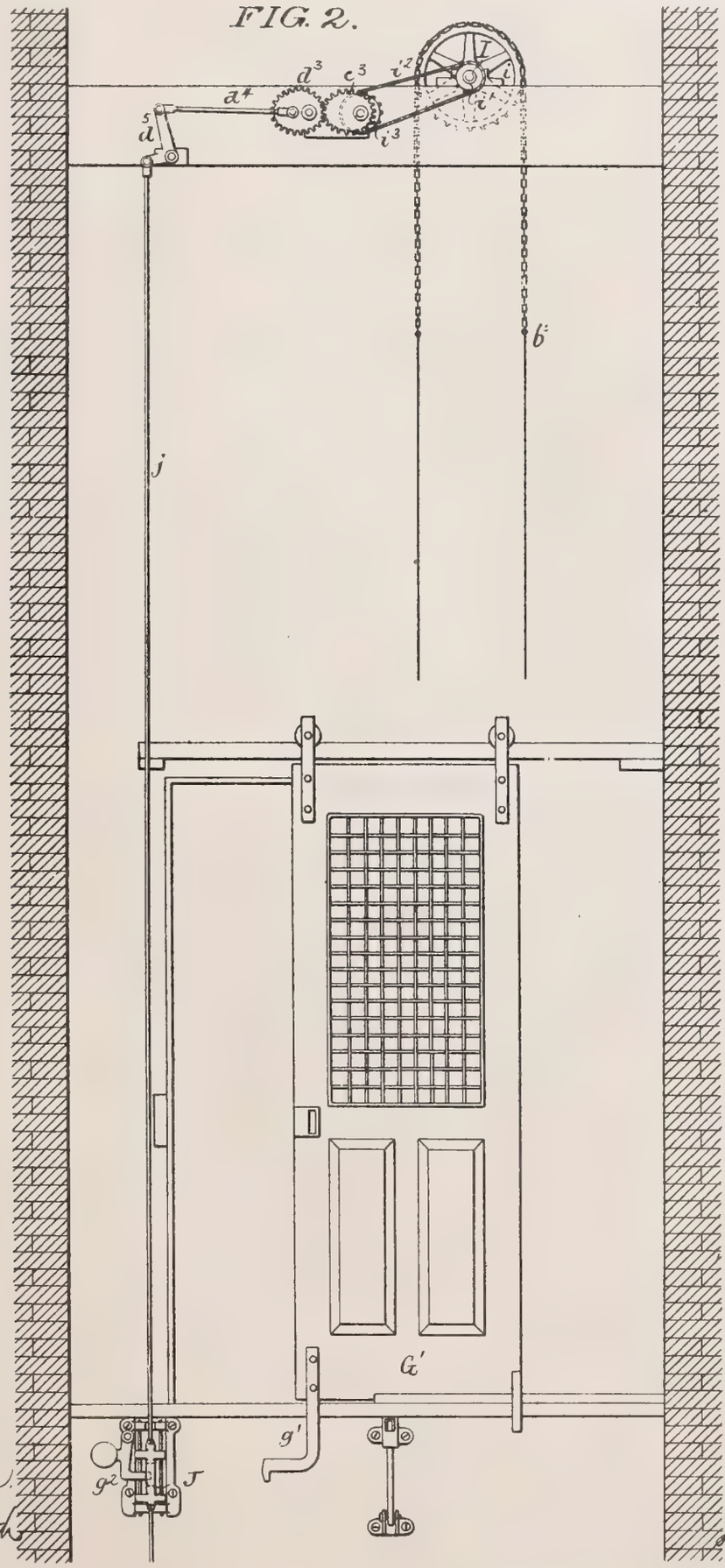
(No Model.) 2 Sheets—Sheet 2.

J. S. MUCKLÉ.

ELEVATOR MECHANISM.

No. 583,331. Patented May 25, 1897.

FIG. 2.



Witnesses:
Jos. A. Klein.
Harry Smith.

Inventor:
John S. Muckle
by his Attorneys
Howson & Howson

THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN S. MUCKLE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO M. R. MUCKLE, JR., & CO., OF SAME PLACE.

ELEVATOR MECHANISM.

SPECIFICATION forming part of Letters Patent No. 583,331, dated May 25, 1897.

Application filed May 11, 1896. Serial No. 591,110. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. MUCKLE, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Elevator Mechanism, of which the following is a specification.

My invention relates to certain improvements in passenger and freight elevators in which controlling mechanism is used for stopping the car at the different landings. In all elevator-controlling mechanism there is a point where the movement of the mechanism exercises no effect to stop or start the car. This movement I will call hereinafter the "idle" movement of the controlling mechanism.

The object of my invention is to utilize this idle movement of the controlling mechanism to release the door when the car is at a landing and to lock the door when the door is closed and before the car is moved.

My apparatus is so arranged that after the controlling mechanism is shifted and has stopped the car, for instance, further movement of this mechanism is utilized to move a slide or other locking device to release the door, and when the door is opened the said slide will be locked and thus lock the controlling mechanism while the door is open, and a continued further movement or return movement of the controlling mechanism after the door is closed is utilized to lock the door, the door when closed releasing the controlling mechanism, so that it can be operated to start the car.

In the accompanying drawings, Figure 1 is a side view of sufficient of an elevator well and car to illustrate my invention. Fig. 2 is a view of a modified form of the mechanism. Fig. 3 is a view of a still further modification of the invention, and Fig. 4 is a detailed view of the mechanism shown in Fig. 1.

Referring in the first instance to Figs. 1 and 4, A is the car, which is adapted to travel up and down in the elevator-well. H is the landing, and in the present instance G is a sliding door.

Mounted in suitable bearings in the car is a shaft B, having a hand-wheel b within the car and a sprocket-wheel b' on the outside of the car around which passes the valve-controlling chain b^2. The shaft, hand-wheel, and sprocket-wheel form the controlling mechanism on the car. On the shaft B is a pinion b^3, around which passes a chain c to the chain-wheel c' on the intermediate shaft C. On this shaft C is an eccentric gear-wheel c^2, which meshes with an eccentric gear-wheel d^2 on the stud D.

To a crank-pin d on the wheel d^2 is connected a rod d', attached to an arm e on the rock-shaft E, adapted to bearings secured to the under side of the car in the present instance.

F is a slide adapted to guides f, and this slide is connected to the arm e on the rock-shaft E by a rod e'. This slide has at its outer end a flange f' on one side and a roller f^2 on the opposite side and is the movable element.

On the walls of the elevator-well near each landing is a spring-latch g, which engages with a latch g' on the door G, and at one side of this spring-latch is hung a lever S, having an arm s, adapted to pass back of the flange f' on the slide F when the said slide is projected and the door opened. s' is a weighted arm, and s^2 is an arm with which comes in contact a finger g^2 on the door, so that when the door is closed this finger strikes the arm s^2, turning the lever and throwing its arm s away from the flange f', and thus releasing the slide. Thus it will be seen that when the lever S engages with the slide it will prevent the operator from turning the controlling mechanism, as the slide is connected with said mechanism.

The above-described mechanism with the exception of the eccentric gears is fully described and set forth in the Patent No. 555,825, on March 3, 1896.

By arranging the eccentric gears in the manner shown I am enabled to so regulate the throw of the slide that during the time that the valve mechanism is shifting very little motion is imparted to the slide, but immediately after shifting the valve the gears are brought into such relation to each other and to the crank-pin that the slide is projected its full extent.

In all elevating mechanism a certain amount of motion is given to the wheel, if a wheel is used, beyond that required to shift the valve to stop the elevator, and it is this motion that I utilize to shift the slide. The

same motion is utilized on the return of the wheel to withdraw the slide before the valve is reversed to start the car, the door in the meantime having been closed so as to release the slide from the mechanism hung to the elevator-well.

In Fig. 2 I have shown the eccentric gears arranged at the head of the elevator-well and actuated by the controlling rope or chain b^2 through the medium of the wheel i, mounted on the shaft I, sprocket-wheel i', chain i^2, and sprocket-wheel i^3, mounted on an intermediate shaft on which is an eccentric gear c^3, meshing with an eccentric gear d^3. On this gear is a crank-pin to which is attached a rod d^4, connected to the bell-crank lever d^5, to which is attached the rope j, having the blocks J at each landing. These blocks engage with an L-shaped latch g' on the elevator-door G' and are engaged by a weighted lever g^2 when the door is open. This particular mechanism is described and claimed in an application filed by me on the 20th day of February, 1896, Serial No. 580,119, with the exception of the elliptical gears. By placing the elliptical gears in the position shown the same result is accomplished as by that shown in Fig. 1.

I may dispense in some instances with the elliptical gears, as shown in Fig. 3, and connect the rod d' to a slotted arm D', pivoted to a frame, and in the slot of this arm is a pin projecting from the gear-wheel C. By this means I obtain a differential motion, the parts being so timed that the slow movement is given to the slide while the valve-shifting mechanism is operating and the quick motion is given either after or before the valve mechanism is operated.

It will be understood that my invention can be applied to belt-shifting mechanism or clutch mechanism as well as to valve mechanism and can be also applied to shifting mechanism of an electric elevator.

I claim as my invention—

1. The combination in elevator-locking mechanism, of a car, a door, a lock therefor, a device for operating the controller whereby the car is caused to ascend or descend, mechanism for actuating the lock to release the door after the car is brought to a stop at the door and means whereby said mechanism is operated from the controlling device after the latter has been moved so as to stop the car, substantially as described.

2. The combination in elevator-locking mechanism of a car, a door, a lock therefor, a device on the car for operating the controller whereby the car is caused to ascend or descend, mechanism for actuating the lock to release the door after the car is brought to a stop at the door and means whereby said mechanism is operated from the controller device on the car after the latter has been moved so as to stop the car, and a device for locking the controller and its mechanism when the door is opened, said device being actuated to release the controller when the door is closed so that the said mechanism can be operated to again lock the door before the controller device is moved sufficiently to start the car, substantially as described.

3. The combination in an elevator-car, of the door, a lock therefor, controlling mechanism on the car, a movable element adapted to actuate the door-lock, with elliptical gearing between said controlling mechanism and the movable element whereby said element will be moved slowly during the stopping and starting of the car, and will be moved quickly after or before the controlling mechanism is actuated to stop or start the car, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN S. MUCKLÉ.

Witnesses:
WILL. A. BARR,
JOS. H. KLEIN.

(No Model.)

3 Sheets—Sheet 1.

J. S. MUCKLÉ.

ELEVATOR MECHANISM.

No. 583,332. Patented May 25, 1897.

FIG. 1.

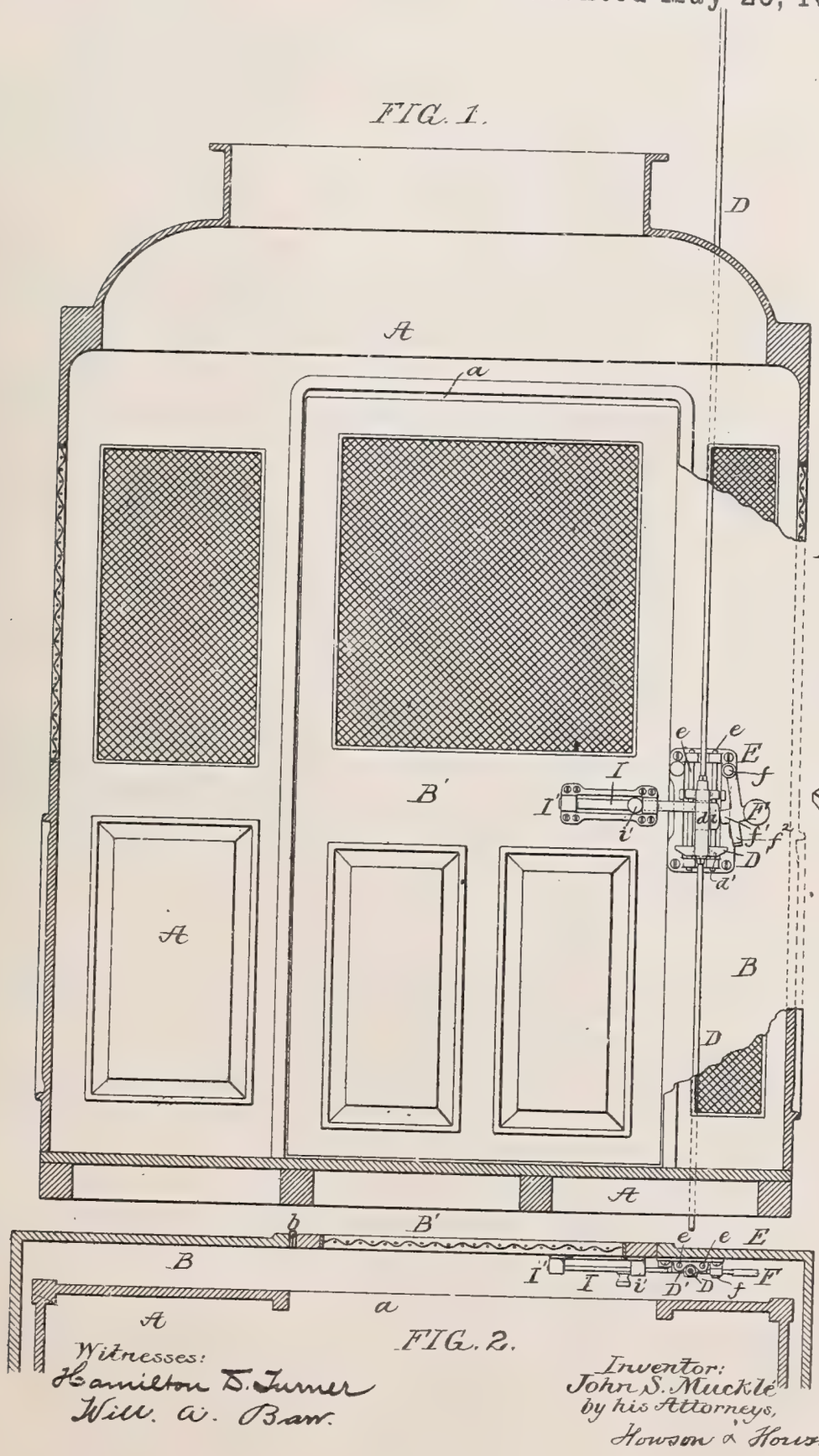


FIG. 5.

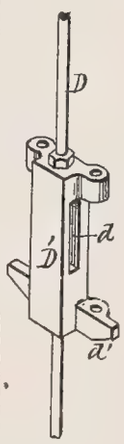


FIG. 2.

Witnesses:
Hamilton D. Turner
Will. A. Barr.

Inventor:
John S. Mucklé
by his Attorneys,
Howson & Howson

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(No Model.) 3 Sheets—Sheet 2.

J. S. MUCKLÉ.

ELEVATOR MECHANISM.

No. 583,332. Patented May 25, 1897.

FIG. 3.

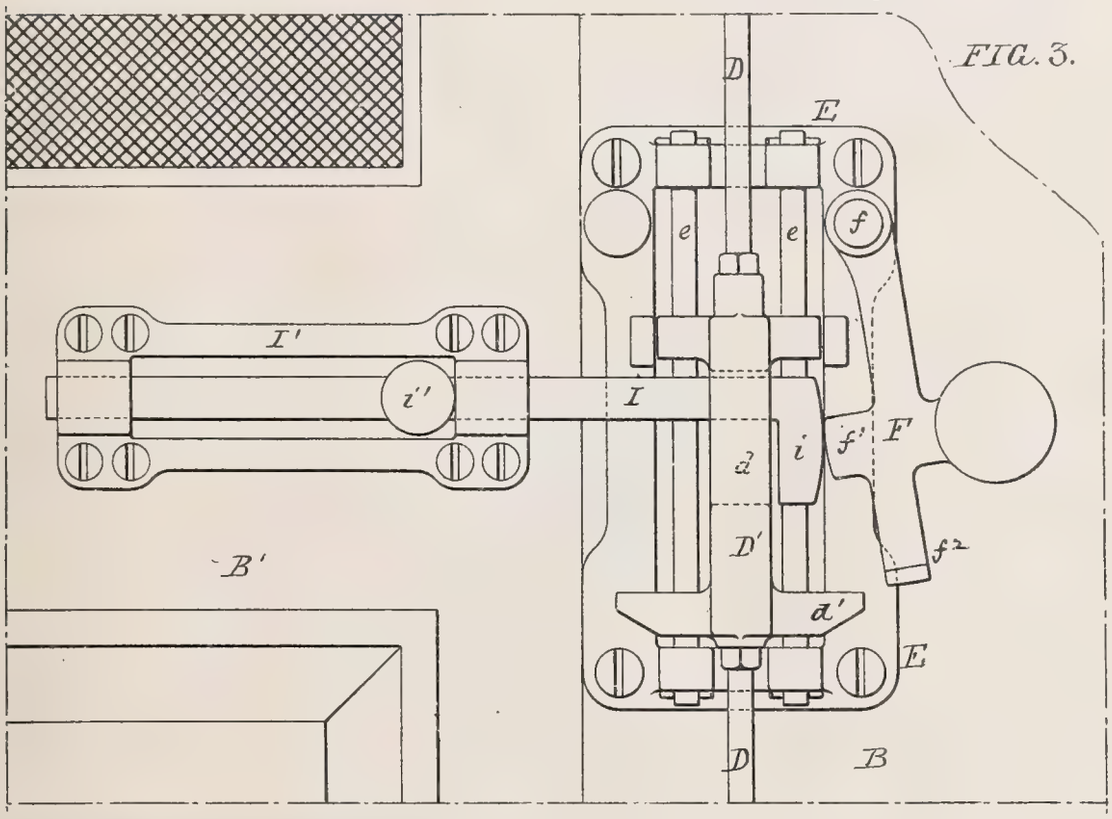
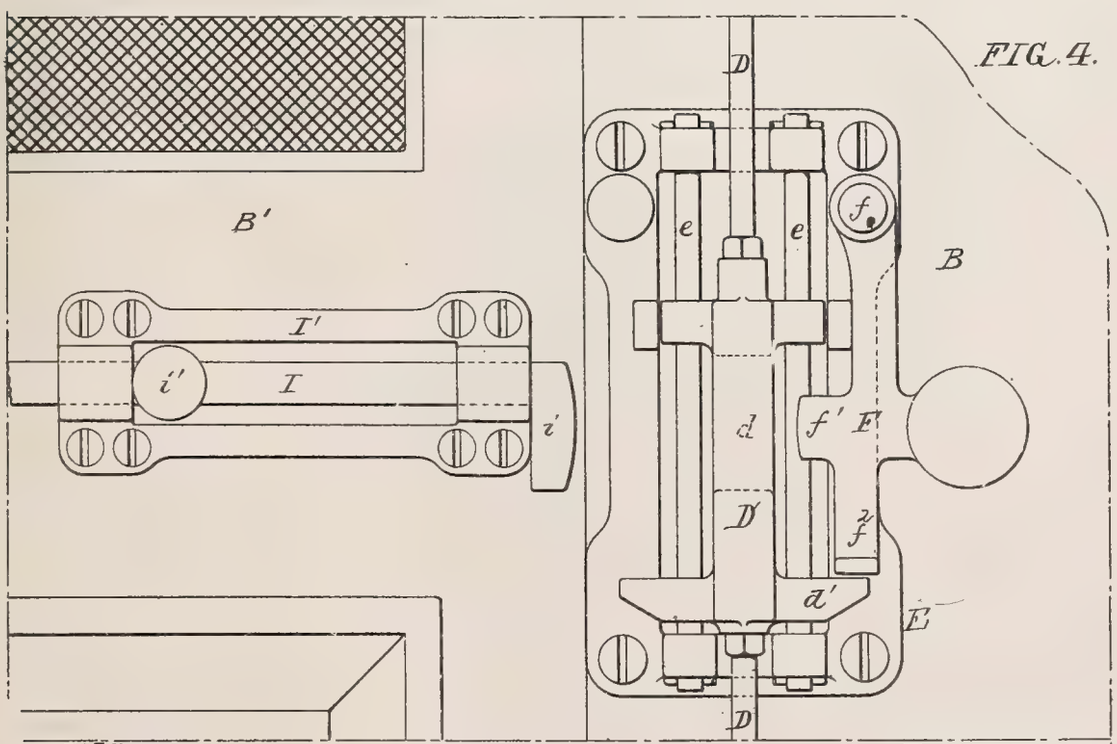


FIG. 4.



Witnesses:
Hamilton B. Turner
Will. A. Barr.

Inventor:
John S. Muckle,
by his Attorneys,
Howson & Howson

THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

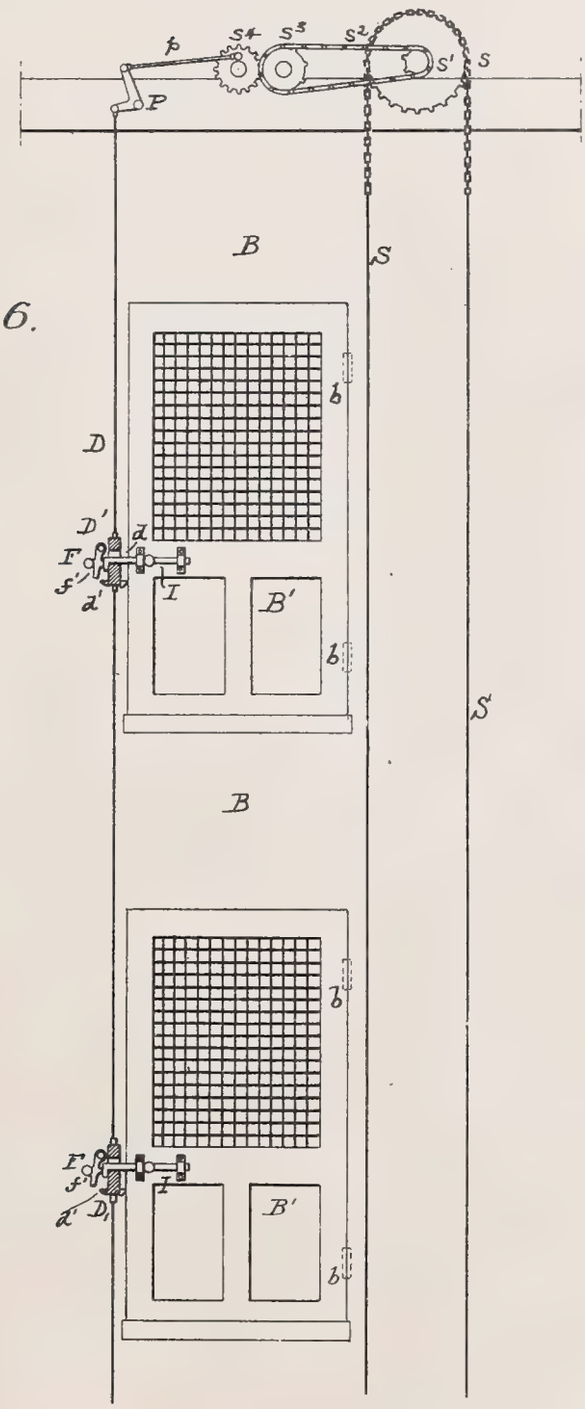
(No Model.) 3 Sheets—Sheet 3.

J. S. MUCKLÉ.

ELEVATOR MECHANISM.

No. 583,332. Patented May 25, 1897.

FIG. 6.



Witnesses:
Charles De Cow
Will. A. Barr.

Inventor:
John S. Muckle
by his Attorneys
Howson & Howson

THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN S. MUCKLÉ, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO M. R. MUCKLÉ, JR., & CO., OF SAME PLACE.

ELEVATOR MECHANISM.

SPECIFICATION forming part of Letters Patent No. 583,332, dated May 25, 1897.

Application filed December 31, 1896. Serial No. 617,639. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. MUCKLÉ, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Elevator Mechanism, of which the following is a specification.

The object of my invention is to provide mechanism for locking the car of an elevator when opposite a landing and when the landing-door is opened and to lock the landing-door in the closed position when the elevator-car is not at the landing.

My invention is especially adapted for use in connection with hinged landing-doors which either swing out from the elevator-car or into the car and in which the controlling mechanism is governed by mechanism within the car of the rope or rod type.

In the accompanying drawings, Figure 1 is a vertical sectional view of an elevator-car with the landing-door in the distance. Fig. 2 is a plan view of sufficient of the elevator well and car to illustrate my invention. Fig. 3 is an enlarged view of the locking mechanism in the position shown in Fig. 1. Fig. 4 is a view of the locking mechanism, showing the bolt withdrawn; and Fig. 5 is a perspective view of the block. Fig. 6 is a view showing the landing-door-locking mechanism and controlling-rope.

A is the car, having the usual passage-way *a*.

B are the walls of the elevator-well, and B′ is one of the landing-doors, hinged at *b* to swing out from the elevator-car.

D is a rope, chain, or rod within the elevator-well and provided with a series of blocks D′ and forming a movable element. This element is connected with any suitable controlling mechanism so that it will have a certain limited vertical movement when the said mechanism is actuated.

Referring to Fig. 6, S is the controlling-rope, which passes around a wheel *s* at the head of the elevator-well, and on the shaft of this wheel is a sprocket-wheel *s′*, around which passes a chain s^2 to a sprocket-wheel s^3, carrying a gear-wheel which meshes with a gear-wheel s^4. P is a bell-crank lever one arm of which is connected to the rod or cord D, and the other is attached to a rod *p*, connected to a crank-pin on the wheel s^4, so that when the controlling-rope S is operated the blocks will be raised or lowered and when the blocks are locked the controlling-rope is also locked.

One of the blocks D′ is situated near each landing and adapted to guide rods *e e* on a plate E, in the present instance, which is secured to the inner wall of the elevator-well. Each block is perforated at *d* to allow for the passage of the headed bolt I. In the present instance this bolt has an L-shaped head *i* and is adapted to a plate I′, secured to the door B′, and has also a handle *i′*, by which it is operated. The bolt has sufficient movement so that it can be drawn back clear of the door-jamb, as shown in Fig. 3, and can be projected entirely through the block D′, as shown in Figs. 1 and 4, so that it will be engaged by the block when the block is moved.

Pivoted at *f* to the plate E is a weighted arm F, having a projection *f′*, which rests against the end of the bolt I when it is in the block. The end f^2 of the arm passes over a projection *d′* on the block D′ when the bolt I is withdrawn, so as to lock the block from any vertical movement while the bolt is free and the door opened. As soon as the door is closed and the bolt thrown the end of the bolt will strike the projection *f′* and will force the arm F away from the block and its end f^2 out of engagement with the projection *d′* of the block, thus releasing the block and its mechanism and allowing the controlling mechanism to be operated to raise or lower the car. The bolt allows the block to move up a certain distance with the controller, so that when the block is raised it will prevent the withdrawal of the bolt, and consequently the opening of the door, until the elevator-car again comes to a rest. By this means I can readily apply locking mechanism to elevator-plants provided with hinged or swinging doors as readily as those having sliding doors.

By arranging the arm F as shown the arm will lock the block before the bolt leaves it, so as to insure either the locking of the door by the block or the locking of the block by the arm.

I claim as my invention—

1. The combination of the elevator-well, a

hinged landing-door, an elevator-car, controlling mechanism, a movable element in the elevator-well connected to the controlling mechanism, a pivoted arm adapted to prevent the movement of the said element when the door is opened and a slidable bolt on the hinged door adapted to be engaged by the said element when the door is closed, substantially as described.

2. The combination of an elevator-well, a hinged landing-door, an elevator-car, controlling mechanism, a rope connected to the controlling mechanism, a perforated block on said rope opposite the door, a pivoted arm adapted to engage the block, a sliding bolt on the door having a head at one end, said bolt being adapted to enter said perforated block when the door is closed and to release the block from the control of the pivoted arm, so that on the withdrawal of the bolt the car will be locked and the door may be opened, substantially as described.

3. The combination of the elevator-well, a landing-door, a bolt thereon, a car, controlling mechanism, a movable block connected to the controlling mechanism, said block having a projection, a pivoted arm adapted to engage with the projection on the block and to be acted upon by the bolt of the door, substantially as described.

4. The combination of the elevator-well, a landing-door, an elevator-car, and controlling mechanism, a plate E secured on the wall of the well, a perforated block adapted to slide on the plate, a bolt on the door adapted to enter the perforation in the block, an arm pivoted to the plate E and having a projection in line with the bolt and an end adapted to engage a projection on the block when the bolt is withdrawn so as to prevent the vertical movement of the block, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN S. MUCKLÉ.

Witnesses:
WILL. A. BARR,
JOS. H. KLEIN.

(No Model.)

S. D. STROHM.

SAFETY DEVICE FOR ELEVATORS.

No. 583,696. Patented June 1, 1897.

Fig. 1

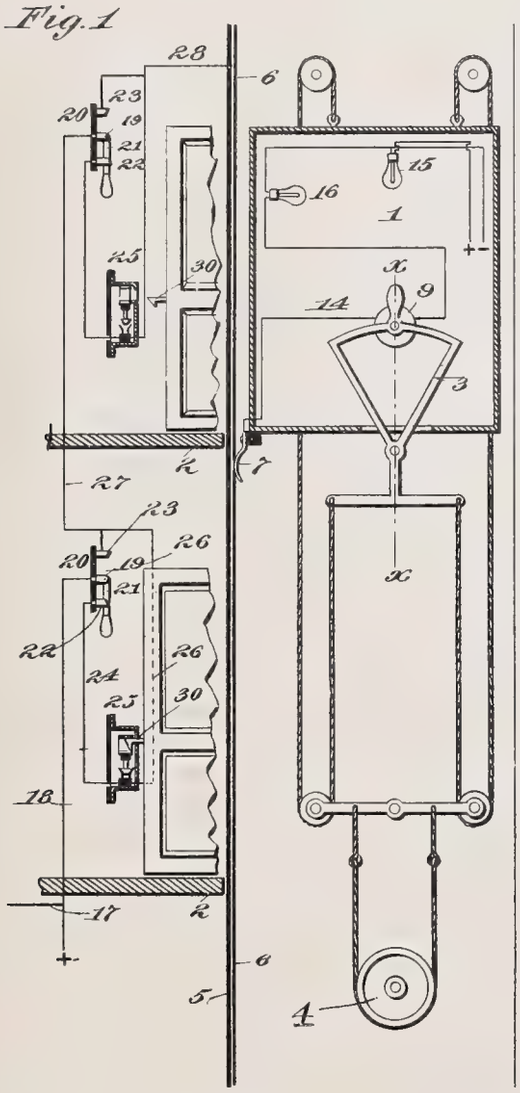


Fig. 2

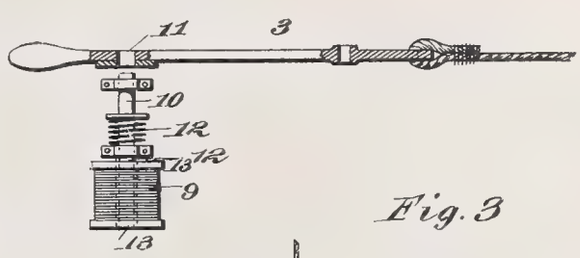


Fig. 3

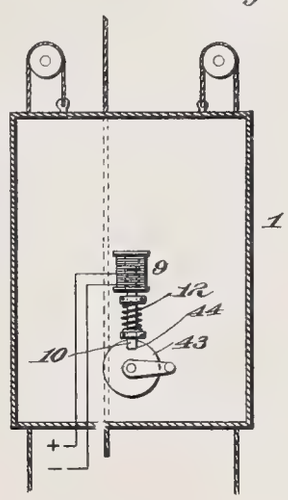


Fig. 4

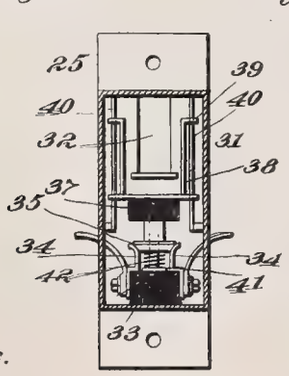


Fig. 5.

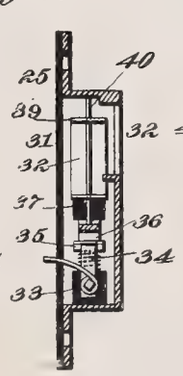
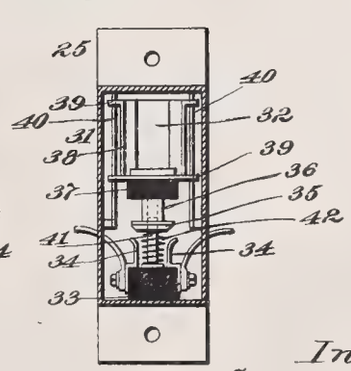


Fig. 6.



Witnesses.

J. F. Coleman

Frank L. Ayer

Inventor
Samuel D. Strohm

by R. A. Morrison

THE MORRIS PETERS CO. WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

SAMUEL D. STROHM, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE STROHM ELEVATOR SAFETY DEVICE COMPANY, OF SAME PLACE.

SAFETY DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 583,696, dated June 1, 1897.

Application filed April 4, 1896. Serial No. 586,213. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL D. STROHM, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Safety Devices for Elevators, (Case C;) and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to various new and useful improvements in safety devices for elevators, which are designed particularly for use with passenger-elevators, and the improvements are of such a character that they may be applied to and used in connection with any variety of elevators.

The object of the invention is to provide a safety device for elevators of such a character that absolute safety of operation of the elevator-car will be assured.

To this end the invention consists in the provision of electrically controlled or operated mechanism by means of which, should any one of the landing-doors be open or otherwise unsafe or insecure, so as to operate the closers and breakers in the safety-circuit, the operating mechanism of the elevator will be locked and can only be started when the said doors are properly secured.

In order that my invention may be better understood, attention is directed to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a diagrammatic view of a conventional form of elevator, showing the applicability thereto of my present improvements; Fig. 2, a section on the line *x x* of Fig. 1; Fig. 3, a detail view of the preferred manner of applying an electrically-operated lock to the actuating-motor; Figs. 4, 5, and 6, detail views of the preferred form of circuit-closer at the landings, adapted to be operated by the actual securing of the landing-doors.

In all of the above views corresponding parts are represented by the same reference-numerals.

1 is an elevator-car movable in a suitable well or shaft past the landings 2 2.

3 is a controlling-lever for operating a pulley-wheel 4 by suitable appropriate intermediate connections, and to which pulley is connected the valve or other controlling element of the operating mechanism.

5 is an insulated strip secured to one side of the well or shaft, and which may be conveniently made of wood, and 6 is a metallic contact strip or track secured to said insulated strip.

7 is a sliding contact carried on the car 1 and making contact with said contact-strip 6.

9 is a solenoid or magnet carried in the car adjacent to the controlling-lever 3 and which is supported in any suitable way. If desired, said solenoid or magnet may be suitably incased.

10 is a locking-bolt adapted to engage an opening 11 in the controlling-lever 3 when said controlling-lever is brought to its central position to close the elevator-valve and stop the car, said latch being normally forced into engagement with said opening by means of a spring 12. Said bolt 10 is connected with the core or armature 13 of the solenoid or magnet 9 and may conveniently be an extension of said core or armature, as shown in Fig. 2. In the arrangement shown the solenoid or magnet 9 is in a circuit 14 between the brush 7 and one side of the circuit of the elevator-lamp 15 for lighting the car, and, if desired, a resistance 16 for cutting down the current flowing through said solenoid or magnet may be included in said circuit. Instead of employing as the source of electric supply the lighting-circuits of the building a primary or storage battery or other source may be availed of, with which the electric connections are to be suitably made.

In carrying out my invention I interpose between the other side 17 of the current-supply and the magnet 9 suitable circuit making and breaking devices controlled by the landing-doors or other door or doors opening on the elevator-shaft, so that unless said doors are closed and preferably secured current will be prevented from passing to said solenoid or magnet for unlocking the elevator-actuating mechanism, as will be explained. A convenient arrangement for doing this is illustrated in Fig. 1 and will be described.

Extending from one side of the source of current-supply is a wire 18, which leads to the pivoting-point 19 of a switch 20, carried on the first landing, and which preferably is incased, so that it cannot be tampered with. The switch-lever 21 of this switch makes contact with the contact-plates 22 and 23.

Extending from the contact-plate 22 is a wire 24, which passes through a circuit-breaker 25 of any suitable construction. From said circuit-breaker a wire 26 extends to the other contact-plate 23 of the switch. From the latter contact-plate 23 a wire 27 extends to a switch 20 on the floor above, where similar electric connections are made, and from the plate 23 of the switch at the extreme upper floor of the building a wire 28 connects with the contact-strip 6, with which the brush 7 is constantly making contact.

The operation of the apparatus described above, and which is shown in Fig. 1, will be readily understood and is as follows: When all the landing-doors are closed, the circuit from the lamp 15 to the other main 17, or through any other source of supply, is closed through the circuit-breakers at the landings and the solenoid or magnet 9 on the car, so as to retract the core or armature 5 and withdraw the bolt 10. Whenever the car is stopped and the lever is brought to its central position, so as to close the elevator-valve, and the landing-door at which the car is stopped is opened, so as to break this circuit, the solenoid or magnet 9 will be deënergized, allowing the spring 12 to force the bolt 10 into the recess 11 of the controlling-lever, and said lever will thereby be locked against movement. It will therefore be impossible to start a car in this position, and said car can only be started by closing the landing-door, completing the circuit, thereby energizing the magnet or solenoid, retracting the bolt 10, and freeing the controlling-lever 3. If for any reason any one of the circuit-breakers at the landings is out of order, the switch-lever 21 of the switch at that floor may be thrown over into contact with the upper contact-plate 23, so as to cut out the circuit-breaker at that floor. This will allow the car to be operated, and the said circuit-breaker may be repaired without affecting the operation of the car.

I have found from experience that when the current obtained is supplied from the electric-light circuit of a building it is necessary that all parts be carefully insulated, as any ground through the iron work of the elevator-shaft is very objectionable and often fatal to correct operation, and by means of the construction shown this result is obtained, it being noted that the bases of the switches 20 and other parts are mounted on heavy insulated blocks.

Preferably the circuit-breakers at the landings are controlled by the actual securing of the doors, or, in other words, the circuit through said circuit-breakers is closed by the latch 30 of the landing-doors. It is to be understood, however, that other forms of circuit-breakers may be employed, as will be suggested to those skilled in the art.

In Figs. 4, 5, and 6 I illustrate a convenient form of circuit-breaker of the first class, to which attention is now directed.

31 is the body of the lock, mounted on a heavy insulated block and having an opening or slot 32 therein, into which the latch 30 passes.

33 is an insulated block made, preferably, of hard rubber secured within the plate 31 and carrying contact-springs 34 34 at each side thereof.

35 is a contact-plate adapted to make contact between said springs 34 34, said plate being carried on a sleeve 36, secured to an insulating-block 37. Said block is carried in a light frame 38, having slotted arms 39 thereon, which arms engage with and are guided by small guide-bars 40, secured within the casing 31.

41 is a guide-piece secured to the sleeve 36 and working within a hole in the insulating-block 33, and 42 is a light spiral spring, interposed between said insulating-block and said contact-plate 35 for normally elevating the same from the springs 34 34. With this form of circuit-closer the latch 30 entering the slot 32 will come into contact with the top of the insulating-piece 37 and will force the contact-plate 35 downward, so as to complete the circuit between the springs 34 34. When said latch is elevated to unlock the door, the spring 42 will force the contact-plate 35 upward to break the circuit at the landing, as will be understood. This form of circuit-breaker I have found to be very convenient in practice and it possesses the advantages of being simple and reliable.

Instead of locking the controlling-lever 3 when it has been brought to a central position, as illustrated in Fig. 1, the controlling-wheel 43 may be used, as shown in Fig. 3, provided with a slot 44 therein, which will be engaged and locked by a bolt 10 when said wheel is brought to its central position to close the elevator-valve.

Having now described my invention, what I claim as new therein, and desire to secure by Letters Patent, is as follows:

1. In a safety device for elevators, the combination with an element connected with and operating the hydraulic valve or other controlling mechanism of the car, a latch or bolt for locking said element when the same has been brought to a position to hold the car at rest, a solenoid or magnet for operating said latch or bolt, a safety-circuit through said solenoid or magnet, landing-doors adjacent to which extends said safety-circuit, a plurality of closers and breakers in said safety-circuit operated by the latches of the landing-doors, and an insulating-piece interposed between each closer and breaker and the latch for operating the same, whereby the latches

will at all times be insulated from the safety-circuit, substantially as and for the purpose set forth.

2. In a safety device for elevators, the combination with an element connected with and operating the hydraulic valve or other controlling mechanism of the car, a latch or bolt for locking said element when the same has been brought to a position to hold the car at rest, a solenoid or magnet for operating said latch or bolt, a safety-circuit through said solenoid or magnet, a plurality of closers and breakers in said safety-circuit operated by the landing-doors, and a switch at each landing with connections for cutting out the circuit closer and breaker thereat, substantially as set forth.

3. In a safety device for elevators, the combination with an element connected with and operating the hydraulic valve or other controlling mechanism of the car, a latch or bolt for locking said element when the same has been brought to a position to hold the car at rest, a solenoid or magnet for operating said latch or bolt, a safety-circuit through said solenoid or magnet, a plurality of closers and breakers in said safety-circuit operated by the landing-doors, and a switch at each landing with connections for cutting out the circuit closer and breaker thereat, said switches and closers and breakers being mounted on insulated blocks so as to be insulated from the iron-work of the elevator-shaft, substantially as set forth.

4. An improved circuit-breaker for use with electric safety devices, comprising a casing adjacent to the landing-door and having an opening therein in which the latch of the landing-door extends, an insulated block inside of said casing, two contact-springs secured to said block, a contact-plate adapted to make contact with said contact-springs, a frame carried on said contact-plate but insulated from the same, said frame being arranged immediately below the opening in said casing so as to be engaged by the latch of the landing-door, a guide-rod for said frame, and a spring for normally elevating said frame so as to break the circuit between said contact-springs, substantially as set forth.

5. An improved circuit-breaker, comprising a casing 31, an insulated block 33 therein, contact-spring 34, 34, secured to said block, a contact-plate 35, adapted to make contact with said contact-springs, a sleeve 36 carrying said contact-plate, an insulated block 37 to which said sleeve is secured, a frame 38 carrying said sleeve, guide-lugs 39 on said frame, guide-bars 40 with which said frame engages, and a spring 41 beneath the contact-plate 35, normally tending to elevate the same from the contact-springs 34, substantially as set forth.

This specification signed and witnessed this 12th day of March, 1896.

SAMUEL D. STROHM.

Witnesses:
FRANK L. DYER,
L. DELLA MCGIRR.

(No Model.)

C. O. LENZ & C. H. NEWHALL.

CONTROLLER FOR ELEVATORS.

No. 585,112. Patented June 22, 1897.

Fig. 1.

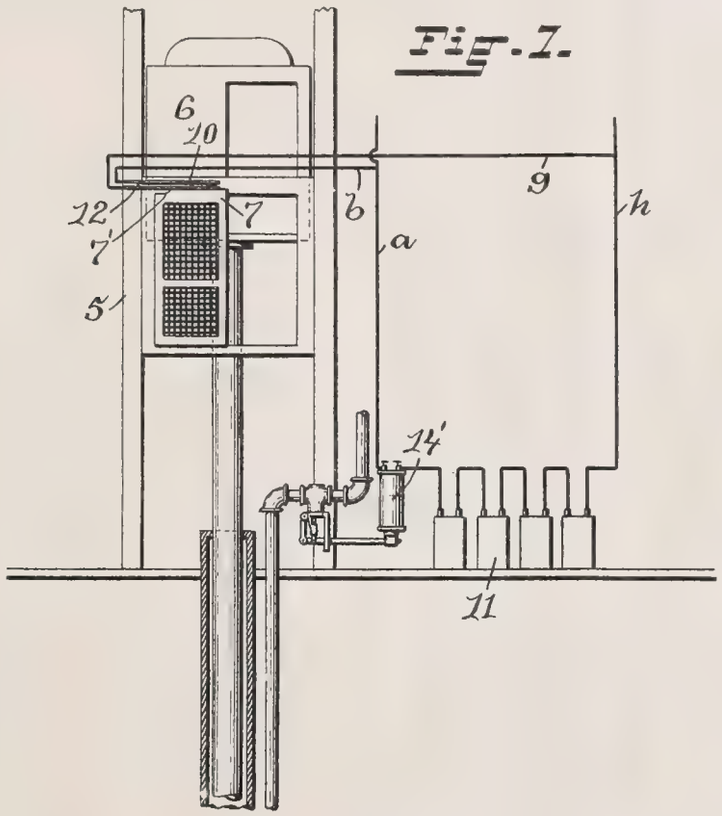
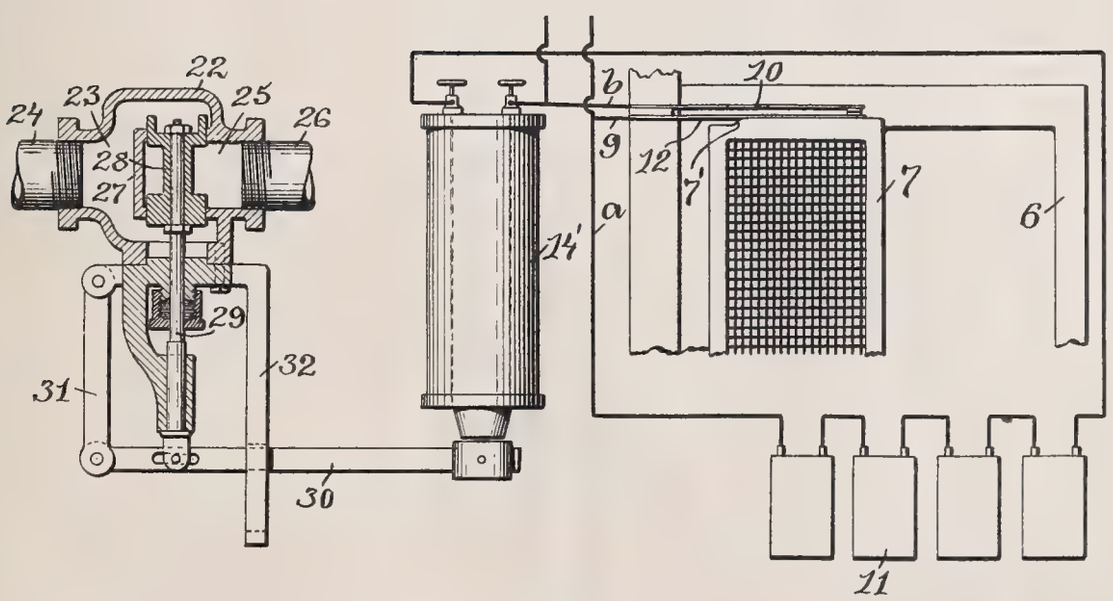


Fig. 2.



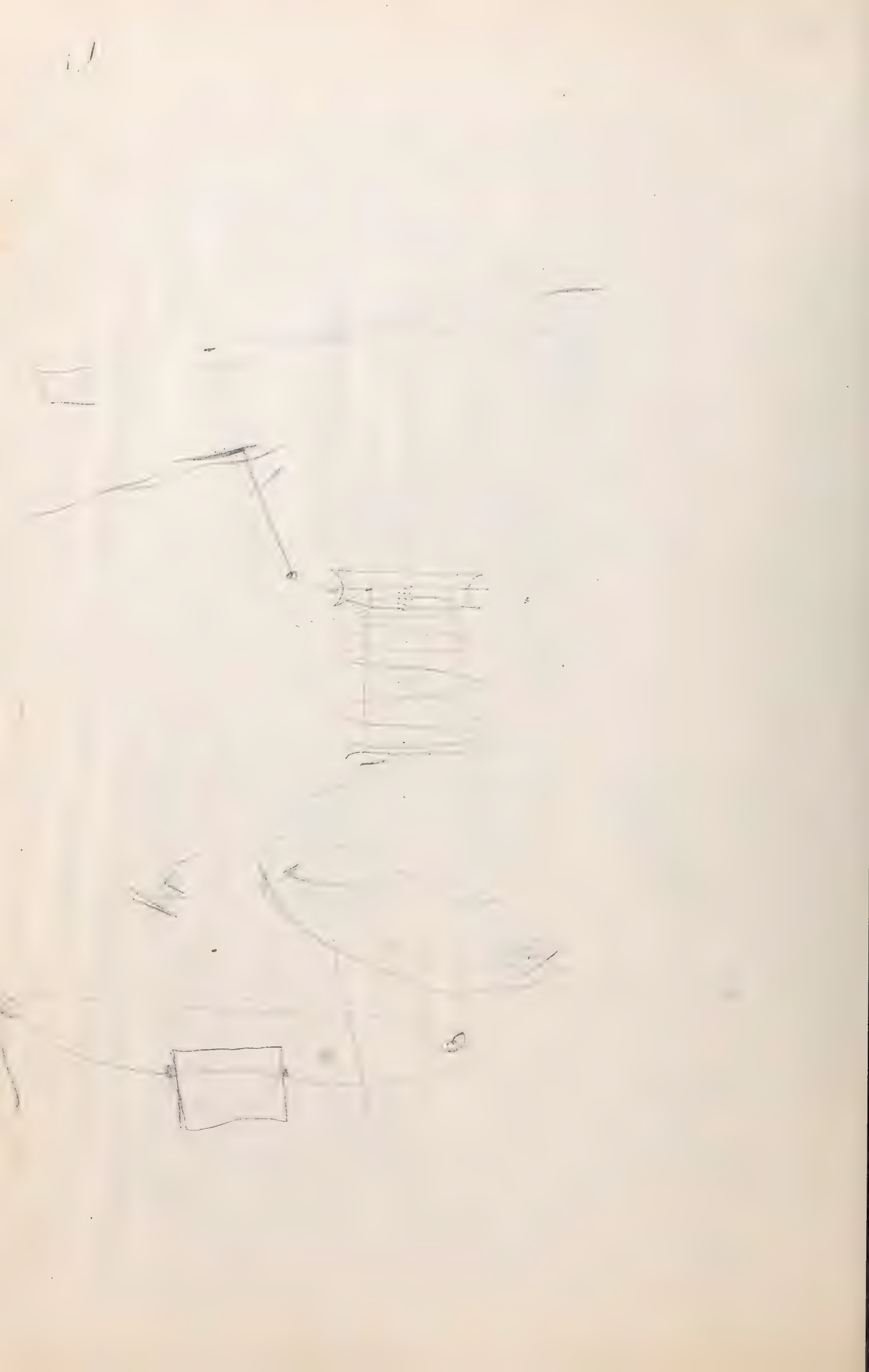
WITNESSES:

Henry J. Miller.
Chas. H. Luther Jr.

INVENTORS:

Charles O. Lenz and
Charles H. Newhall
by Joseph H. Miller & Co.
Attys.

THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.



UNITED STATES PATENT OFFICE.

CHARLES O. LENZ AND CHARLES H. NEWHALL, OF PROVIDENCE, RHODE ISLAND; SAID LENZ ASSIGNOR TO SAID NEWHALL.

CONTROLLER FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 585,112, dated June 22, 1897.

Application filed August 24, 1895. Serial No. 560,443. (No model.)

To all whom it may concern:

Be it known that we, CHARLES O. LENZ and CHARLES H. NEWHALL, of the city of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Controllers for Elevators; and we hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

This invention has reference to improvements in elevator-controlling devices.

The object of the invention is to so construct an elevator that upon the opening of a door leading to the elevator an electrically-actuated stop is brought into play to prevent the operation of the car.

The further object of the invention is to produce a novel electrically-operated safety-stop for elevators.

The invention consists in such peculiar features of construction and combination of parts as are hereinafter described, and pointed out in the claims.

Figure 1 represents a front view of a plunger-elevator, showing the electrically-actuated stop connected with a supply-valve. Fig. 2 is an enlarged view of portions of the same, showing in section details of the supply-valve and its connection with the magnet.

Similar numbers and letters of reference designate corresponding parts throughout.

In the drawings, 5 indicates an elevator-well constructed in any well-known manner and extending through the number of floors of a building which it is desirable to reach by elevator. At each floor access is had to the elevator-shaft and to the car 6, movably supported therein, by means of doors 7 7, mounted to move laterally from before the openings in the front of the elevator-well and having shoulders, as 7′.

The contacts 10 and 12 are connected with an electrical circuit, including the wires *a b* and *g h*, connecting with the battery 11 or other source of electrical energy and with the magnet 14′, located in a position to act on the lever of a supply-valve located between the main water-supply and the elevator-controlling valve.

The supply-valve consists of a casing 22, having the inlet-chamber 23, connected with the supply-pipe 24, and the outlet-chamber 25, connected by the pipe 26 with the elevator-controlling valve. The outlet-chamber 25 has an extension 27, furnished with ports in which the valve 28 is adapted to reciprocate, the valve being constructed to close the ports when raised and to open the same when lowered. Secured to the valve 28 is the valve-stem 29, which extends down through a suitable stuffing-box and is pivotally connected at its lower end with the armature-lever 30, this being pivoted at one end to the rod 31, which in turn is pivoted to a stud extending from the stuffing-box frame. When in the released position, the lever 30 is supported by the arm 32, through a slot in the lower end of which the lever works.

When the contacts 10 and 12 are brought together by the opening of the door 7, the magnet 14′ is energized by the current passing through the completed circuit and the armature end of the lever 30 is drawn upward, the valve 28 being at the same time pushed upward by the valve-stem 29, thus closing the passage for the water or steam to the elevator-controlling valve and preventing the operation of the elevator. When, however, the circuit is broken by the closing of the door, the lever 30 drops away from the magnet 14′, the valve 28 is opened, and the steam or water passes through the valve-ports to the controlling-valve.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. In an elevator-controlling device, the combination with the elevator-car, its operating mechanism, a valve through which fluid may pass to said operating mechanism, and an armature-lever for actuating the valve, of a magnet adapted to act on said armature when energized, an electrical circuit, including a source of electrical energy and open contacts, and a door adapted to close said contacts when opened, as described.

2. The combination with the contacts 10 and 12, the magnet 14′, and an energizing-circuit therefor, of the valve-chamber 22 having the extension 27 furnished with valve-ports,

the valve 28 movable in said ports for opening and closing the same, the valve-stem 29 secured to the valve, the pivotally-supported armature-lever 30 pivoted to the valve-stem and adapted at one end to be attracted by the magnet when energized, and a door adapted to close said contacts when opened.

In witness whereof we have hereunto set our hands.

CHARLES O. LENZ.
CHARLES H. NEWHALL.

Witnesses:
C. H. LUTTER, Jr.,
J. A. MILLER, Jr.

(No Model.) 4 Sheets—Sheet 1.

W. C. FAHY.

ELEVATOR CONTROLLER LOCK.

No. 588,106. Patented Aug. 10, 1897.

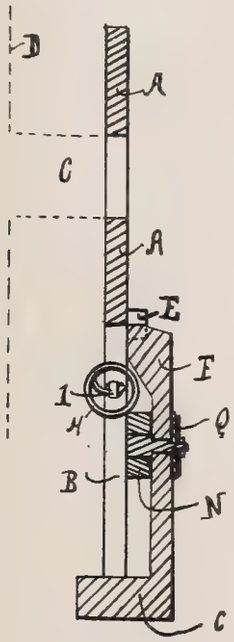


Fig 5

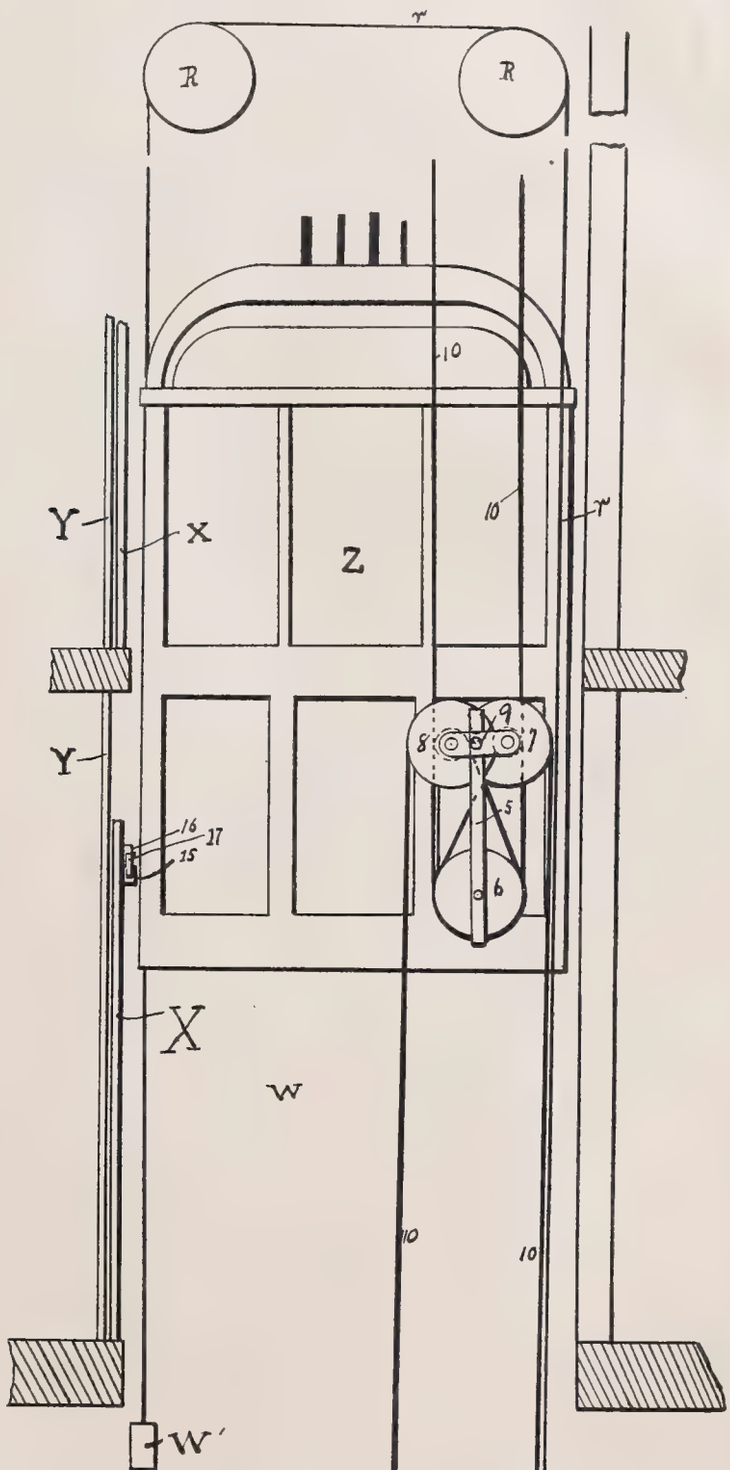
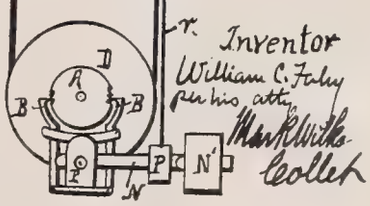


Fig. 1.



Witnesses.
R. C. Wright
Wm. Henderson

Inventor
William C. Fahy
per his attys
Mark W. Wilks
Collett

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 2.

W. C. FAHY.

ELEVATOR CONTROLLER LOCK.

No. 588,106. Patented Aug. 10, 1897.

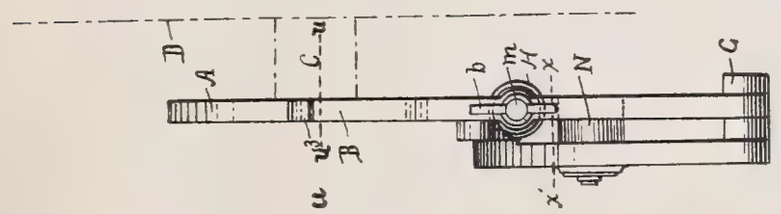


Fig. 3.

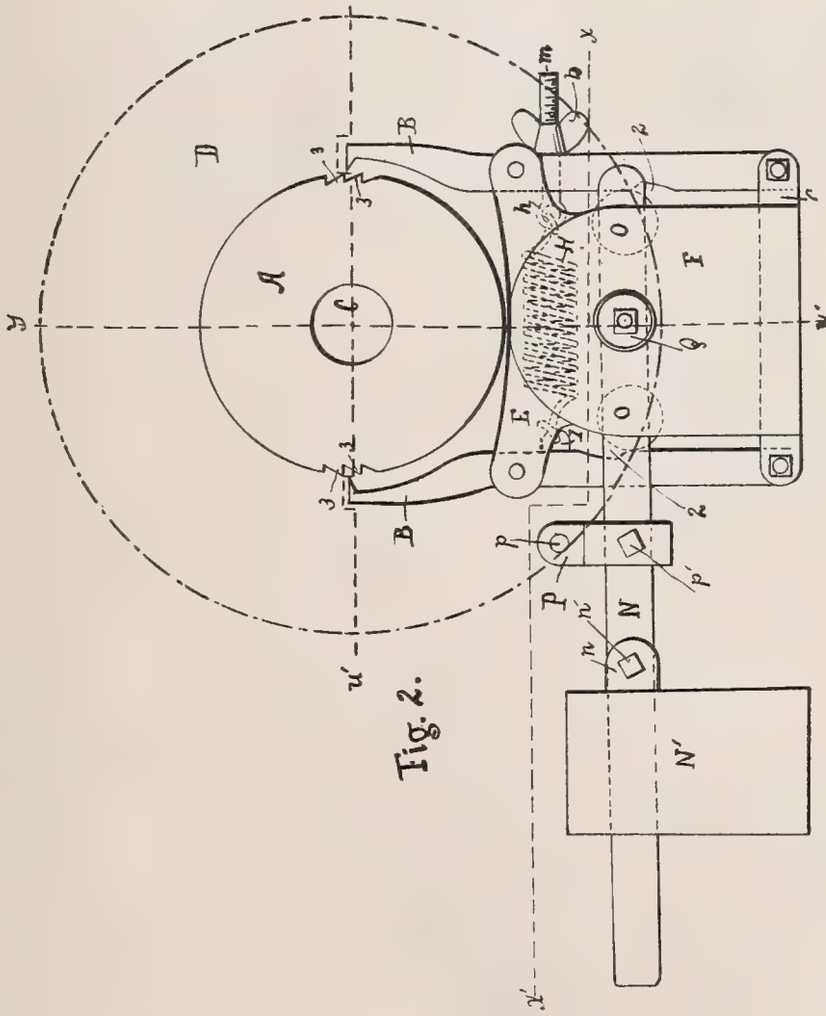


Fig. 2.

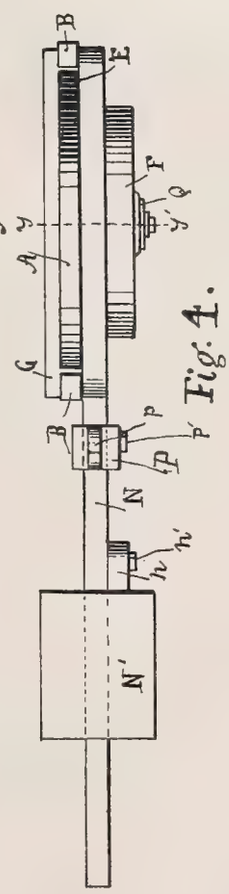


Fig. 4.

Witnesses.
Margaret H. Frederick
Wm. L. Fisher

Inventor
William C. Fahy
per his Attorney
Maxwell & Collier

THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 3.

W. C. FAHY.

ELEVATOR CONTROLLER LOCK.

No. 588,106. Patented Aug. 10, 1897.

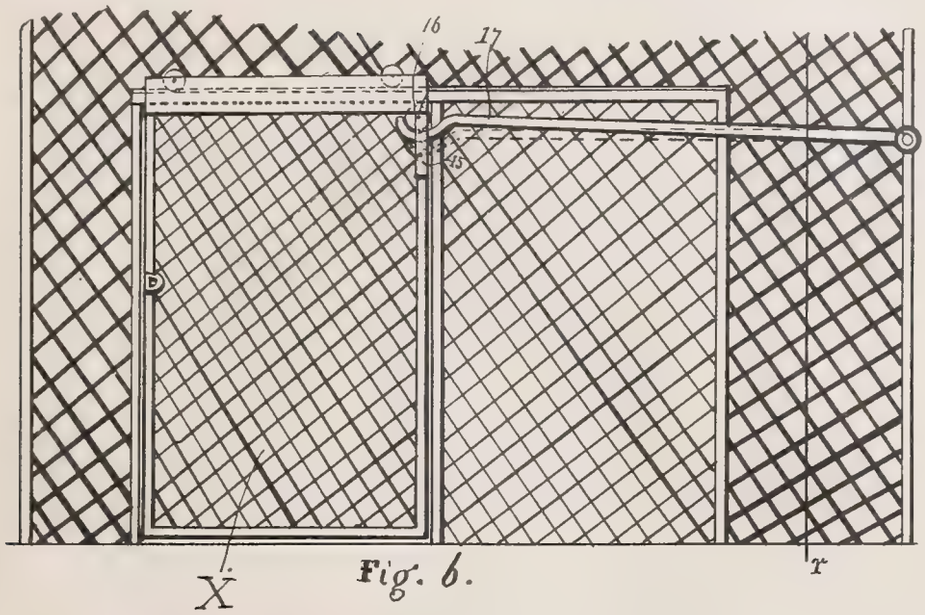


Fig. 6.

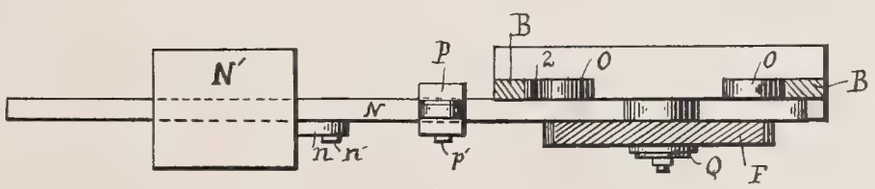
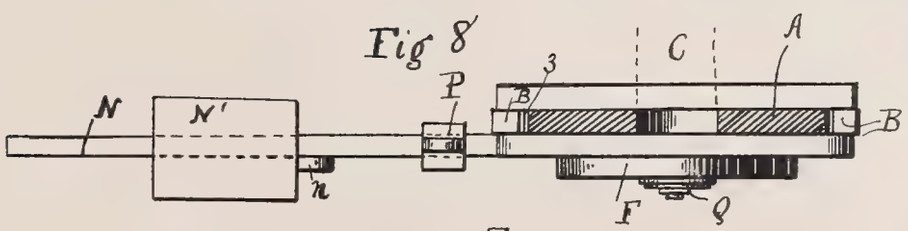


Fig. 7.

Fig 8



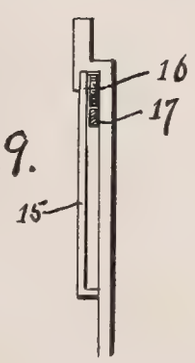


Fig. 9.

Witnesses
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Wm Hendrickson

Inventor.
William C. Fahy
per ark Wilks Collet
ally

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(No Model.) 4 Sheets—Sheet 4.

W. C. FAHY.

ELEVATOR CONTROLLER LOCK.

No. 588,106. Patented Aug. 10, 1897.

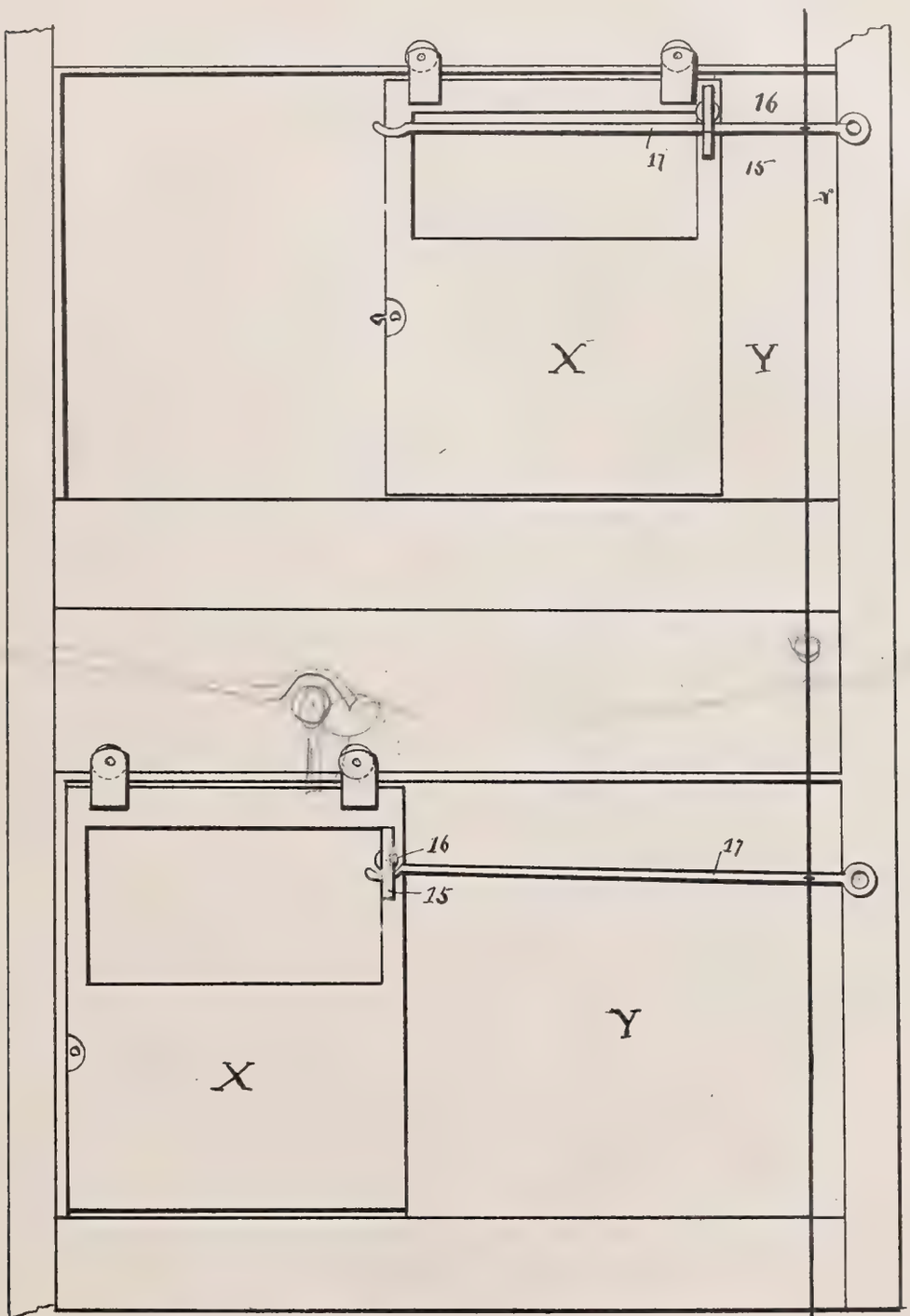

Fig 10

Witnesses
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UNITED STATES PATENT OFFICE.

WILLIAM C. FAHY, OF PHILADELPHIA, PENNSYLVANIA.

ELEVATOR-CONTROLLER LOCK.

SPECIFICATION forming part of Letters Patent No. 588,106, dated August 10, 1897.

Application filed April 4, 1896. Serial No. 586,179. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM C. FAHY, a citizen of the United States, and a resident of the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Elevator-Controller Locks, of which the following is a clear and sufficient specification, reference being had to the drawings annexed.

My invention operates to prevent the turning of the shaft which operates the valve or other starting mechanism or is positively connected with the same or to the controller-cables, so that the controller-ropes will be unable to turn or rotate it when the landing or floor doors, or any of them, are open, and on the other hand to allow this shaft to be turned when these doors are all closed. From this it results that the elevator-car can not move while any of the floor or landing doors are open, and consequently all danger of injury by crushing to people entering the shaft while the elevator-car is in motion is avoided.

My invention consists, essentially, of the following elements: a locking device movable into and out of positive engagement with a device provided with means for positively engaging with the locking device and moving positively with the mechanism operating the starting and stopping mechanism of the elevator, one of which devices moves with shaft above mentioned, mechanism moving said device in and out of engagement with said coöperating keeper device, and mechanical means operated by the landing-doors for causing the moving of said locking device into such engagement when any of the doors are open (thereby stopping the starting mechanism of the elevator and stopping the elevator-car) and moving same out of such engagement, and thereby releasing the valve-operating or other starting mechanism and allowing the elevator-car to be moved upward and downward when all of the doors are shut.

Various other portions of my device I consider to embrace patentable novelty.

Describing now in detail the form of my invention which I find best in practice, Figure 1 is a side elevation of a portion of shaft with the car therein provided with my invented device. Fig. 2 is a front elevation of parts in the neighborhood of the shaft controlling the operation of the valve, and Figs. 3 and 4 are respectively a right side elevation and a plan of same. In the right side elevation no attempt is made, however, to show anything beyond the plane of the line $y\,y'$ of Fig. 2. Fig. 5 is a sectional view along the line $y\,y'$ of Fig. 2. Fig. 6 is an elevation of the inside of one of the floor-landing doors with the devices for operating the cable connected to the device shown in Fig. 2. Fig. 7 is a sectional view along the line $x\,x'$ of Fig. 2. Fig. 8 is a sectional view along the line $u\,u'$ in Fig. 2; and Fig. 9 is a side elevation of a floor or landing door, looking at it from the side toward which it moves when opening. Fig. 10 is a side elevation of several stories of the elevator-well.

The elevator-shaft can be of any ordinary or usual or convenient construction, as can be the hoisting device, car-controlling mechanism, starting device, and means for ingress and egress. All these parts can be varied in all cases to suit the particular problem which the elevator-builder may have to solve in the erection of his plant, and while I have shown a particular form of most of these parts and will particularly describe them in places such description or illustration is not to be taken as any limitation on my invention.

Z is the car, which is provided with any suitable hoisting means and which travels vertically in the shaft W. The sides of a portion of the shaft are formed by the partitions Y Y, provided with floor or landing doors X, which when open allow ingress and egress to the shaft. The car is provided with a controlling mechanism which consists in part of the controller-pulleys 6 7 8, connected together by the rods 5 and 9, which are shifted in the ordinary manner and around which pass the controller-cables 10 10, which pass around the pulley which is secured to the main shaft C, which operates the valve. These cables are usually keyed fast to the wheels to give a more positive coaction between them and the shaft C. The particular form of valve-operating or other starting mechanism and the hoisting mechanism form-

ing no part of my invention are not shown except by the shaft C and will not be further described.

Describing now the locking mechanism. This consists in the best form of my device of which I am now aware of a device secured to the shaft C and turning with it, with which a locking device operated by the opening and shutting of the landing-doors engage when the latter are open and prevents the turning of the device secured to the shaft C. Continuing the description of the said best form, the part attached or positively connected to shaft C is the disk A, provided with ratchet-teeth 3 3, set in opposite directions. The teeth are placed only at the point where the locking mechanism will engage them when the shaft C is so turned that the elevator will be substantially stopped, the other part of the disk being a curved surface over which the parts of the locking device adapted to engage the teeth 3 3 will pass without engaging, so that in case the locking mechanism be thrown into action when the elevator-car is in motion the latter do not engage the disk A, but will pass freely over as indeed they will ordinarily do over the ratchet-teeth set in the opposite direction to those they are intended to engage. The locking device consists in the said best form of the pawls B B, set in a suitable framework and having provisions for yieldingly impelling them into contact with the disk A. These provisions are ordinarily a tension-spring H, which is suitably secured to said pawls, to one by the pierced ear *l* and to the other by the screw-eye *h*, which passes through the pawl and allows the regulation of the tension of the spring by the turning of the nut *b* upon the screw *m*. The framework shown in the drawings forms a very convenient arrangement for the mounting of these pawls and consists of a bed-plate G, in which these pawls are pivoted, and a standard F, which supports the pawls and lever actuating same, as will be further described. The best form of which I am now aware of devices for moving these locking devices toward and away from the co-operating devices provided with means for positively engaging with the locking device on the shaft is as follows:

I employ a yielding provision, such as the spring H, the detailed description of which I have given, to move toward disk A, and I employ devices acting positively upon the pawls to separate them from the disk. The advantages of this arrangement can be clearly seen by considering that if the motion toward the disk be not positive the pawls will not be strained by coming into contact with the outside of the disk in case any landing-door should be opened when the disk is in such position that the teeth of the parts will fall against the circular untoothed periphery of the disk instead of fitting between the teeth. The means I employ for this purpose is a lever N, pivoted between the pawls very conveniently to the standard F at the points. This lever N has provisions for engaging with the pawls B B and moving them away from the disk A as the lever is moved toward a position at right angles with the said pawls. The provisions are rollers O O, engaging with the inner faces of the pawls. To quicken the action of the lever N, I make the rollers moving along the pawls B B to move from a lower to a higher point on the pawls B B, which can very conveniently be done by making notches 2 2, into which the rollers will fall when the lever is shifted, to allow the pawls to contact with the disk and out of which they will be moved as the lever N is moved to separate the pawls from the disk A. In practice I provide this lever N with a sliding lug P, which can be moved along the lever to adjust the amount of motion of the rollers relative to the movement of the means operated by the landing-doors. This is provided with eye *p*. For causing the movement of the lever N in a direction to withdraw the rollers O O from the notches 2 2 I place thereon a weight N′, which is arranged to slide thereon and is provided with set-screw *n′* in the ear *n*, which holds it in position on the lever N.

The form of mechanical means operated by the landing-doors for causing the movements of the locking device out of engagement with the parts coöperating therewith and moving with the main shaft, which is the best of which I am now aware, is as follows: At each door I provide door-operated devices, which are provided with connections extending from same to the device for moving said locking devices out of engagement with the devices, with means for positively engaging with the locking device and coöperating therewith and moving with the main shaft. These door-operated devices in said best form of my device consist of levers of the second class 17, pivoted to the walls of the shaft W at each door intended to be protected and having connected thereto the connections mentioned above. The ends of these levers away from the fulcrum are curved downward and are in engagement with the device coöperating with and placed on the door, this latter, in the best form of my device as aforesaid, being a roller 16, which runs on the top of the lever 17. A guide 15 for the lever is also attached to door. The connection *r* is in practice a wire rope, of small diameter, passing to the upper part of the shaft and connected with the various levers 17 and over the sheaves R R, down to the lug *p*, to which it is secured. If it is necessary to counterbalance the weight of weight N′ more than by weight of levers, a weight W′ can be secured to end of rope.

The operation of the particular form of my invented device which I have described above in detail is as follows: When the landing-doors are all closed, the levers 17 are raised until they stand in the position shown in the

full lines in Fig. 6 and the devices shown in Figs. 2, 3, 4, 5, 8, and 9 stand in the position there shown. The controller mechanism is then free to cause the hoisting device to move the car in any desired direction. If one of the doors open, the roller 16 will depress the lever 17, which will pull down the cable *r*, which will raise the lever N, which will make the rollers O O move into the notches 2 2 and allow the spring H to bring the pawls against the disk A. If the pawls are opposite the teeth 3, they will engage therewith and hold the disk. If opposite any other part, they will not engage, but allow the controller mechanism to be moved into any desired position; but if it is moved to bring them opposite the teeth the position of the starting mechanism will be such that the hoisting mechanism will not move, and the pawls will then catch the teeth and hold the disk until the open door is closed, so that the fulcrum will be about half the width of the lever below the bottom edge of the rollers 16, whereby the top of the lever will be horizontal and will not have any impulse to close until the roller 16 reaches the edge of downward bend near the end of lever 17, and the machine will be locked until the roller has passed this point. When this occurs, the sharp incline will ordinarily serve to close the door and lock it, so that it is practically impossible to avoid closing the door when the door is pushed sufficiently far to unlock the valve or other starting mechanism.

While I have described with great particularity the details of the best form of device of which I am now aware, many changes and alterations can be made therein by a workman skilled in the art without departing from my invention.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an elevator, the combination of a sliding door a lever hung in front of said door, mechanism yieldingly actuating said lever in one direction, said lever having its free end curved in the direction opposite that toward which it is impelled by said mechanism, a guide for said lever, a part connected with the starting mechanism, locking device engaging with said part and connections between said locking device and said lever substantially as described.

2. The combination of means for locking the starting and stopping mechanism of an elevator capable of locking engagement with said mechanism only at positions of the same en the elevator-car is substantially stationary, a lever and connections between said lever and locking means, said lever being adapted to operate said locking means, means for yieldingly moving said lever in one direction, a series of landing-doors, a series of levers adjacent said landing-doors, and adapted to be oscillated on the opening and closing of said doors, and a connection between all of said levers and said lever adapted to operate the locking means, substantially as described.

3. The combination of means for locking the starting and stopping mechanism of an elevator, a lever and connections between said lever and locking means, said lever being weighted at one end and adapted to operate said locking means, a series of landing-doors, a series of levers adjacent said landing-doors and adapted to be oscillated on the opening and closing of said doors, and connection between all of said levers and the said weighted lever, substantially as described.

4. In an elevator, the combination of a rotating device positively connected with the starting and stopping mechanism, a pair of pawls suitably pivoted and having the free ends of each movable in and out of position to engage positively with said rotating device, said rotating device being provided with means for engaging with said pawls only when the elevator is stationary, yieldingly-acting devices for urging said pawls into contact with said rotating device, a landing-door and means whereby the said pawls are moved out of engagement with the said rotating device when the said door is opened substantially as described.

5. In an elevator, the combination of a pair of pawls suitably pivoted and having at the free end of each, a tooth set substantially opposite the tooth of the other, a rotating device positively connected with the starting and stopping mechanism, and provided with means for positively engaging said pawls only at such points on said device as are opposite the teeth of the pawls when the elevator-car is motionless, yielding devices for urging said pawls into contact with said rotating device, a landing-door, a lever adjacent to said door and connections between said lever and said pawls substantially as described.

6. The combination of the disk attached to and moving with the shaft of the starting and stopping mechanism, the pawls secured to a suitable framework and having their teeth on their free ends lying on either side of the disk, teeth on said disk at the points only thereon that will lie opposite the teeth of the pawls when the disk is in the position it will occupy when the starting and stopping mechanism is in position to hold the car substantially motionless and having the rest of the periphery of the disk upon which the pawls may impinge without means for engaging with the same, yieldingly-acting means for drawing said pawls toward each other and toward said disk and means operated by landing-doors acting in opposition to said yielding means for causing the separation of said pawls, substantially as described.

7. In an elevator, the combination with a car, a rotating device positively connected to the starting and stopping mechanism, pawls set in a framework and adapted to positively engage with said rotating device only when

said car is substantially stationary, a lever mounted in said framework, and provided with means for engaging with said pawls, a yieldingly-acting device for yieldingly impelling said pawls in one direction, a landing-door and means operated by the opening and closing of said landing-door for oscillating said lever, substantially as described.

8. In an elevator the combination with a part rotating positively with the starting and stopping mechanism, pawls engaging with the same, a yieldingly-acting device impelling said pawls toward the part with which they engage, a positively-acting device having provisions for engaging with the faces of said pawls, the said faces being raised where said provisions will rest when the pawls are separated and depressed where said provisions will rest when the pawls are drawn toward the said part rotating with the starting and stopping mechanism, a landing-door, a lever adjacent to said landing-door, and connections between said lever and said positively-acting device, substantially as described.

9. In an elevator, the combination of a car, a rotating part positively connected with the starting and stopping mechanism and provided with means for engaging with pawls coacting therewith only at such points as lie opposite said pawls when the car is substantially stationary, pawls, a yieldingly-acting device for yieldingly impelling said pawls toward said rotating part, a rocking lever pivoted between said pawls and having provisions for engaging with the face of said pawls, a yieldingly-acting device acting upon said lever, to cause it to separate said pawls from said rotating part, a landing-door, and mechanism operated by said landing-door for causing the movement to said lever in a direction to separate the pawls from said rotating part substantially as described.

10. The combination of an elevator-car, a locking device for the stopping and starting mechanism and adapted to lock only when said car is substantially stationary, a series of landing-doors, a series of levers opposite said landing-doors and depressed positively by the opening of said doors, a sheave placed above said doors, a flexible connection secured to said levers and extending upward over said sheave and downward from sheave free from engagement with said levers, means for moving said locking device yieldingly actuated in one direction by a yieldingly-acting device and actuated positively in the other by said connection, and means for counterbalancing the weight of said levers, all substantially as described.

11. The combination of a car means for locking the starting and stopping mechanism of an elevator locking only when said car is substantially stationary a lever and connections between said lever and locking means, said lever being adapted to operate said locking means, means for yieldingly moving said lever in one direction, a series of landing-doors, a series of levers adjacent said landing-doors and adapted to be oscillated on the opening and closing of said doors and a flexible connection secured to each of said levers and to said lever adapted to actuate said locking means, substantially as described.

12. The combination of means for locking the starting and stopping mechanism of an elevator, a lever having connections between itself and said locking means, an adjustable weight upon said lever, a series of landing-doors, a series of levers placed opposite said doors, a flexible connection connected to said levers, and to said lever having connections between itself and the locking device, all substantially as described.

13. The combination of a car means for locking the starting and stopping mechanism of an elevator, locking only when the car is substantially stationary a lever, rollers secured to said lever and engaging with said locking device, means for yieldingly moving said lever in one direction, a series of landing-doors, a series of levers adjacent to said landing-doors, and adapted to be oscillated on the opening and closing of said doors, and a flexible connection secured to each of said levers, and extending between them and the lever adapted to actuate said locking means, substantially as described.

14. In an elevator, the combination with a car, a rotating part positively connected with the starting and stopping mechanism, of a locking device, adapted to be moved into and out of positive connection with said part only when the car is substantially stationary, yieldingly-acting means for bringing said locking device into engagement with said rotating part, a positively-acting device operating to move said locking device out of engagement with said rotating part, a series of landing-doors, a series of levers opposite said doors and a flexible connection connecting all of said levers to said positively-acting mechanism, substantially as described.

15. The combination of an elevator-car means for locking the starting and stopping mechanism of an elevator, locking only when said car is substantially stationary yieldingly-actuated means for bringing the locking means into locking engagement with the said stopping and starting mechanism, a lever adapted to operate said locking means, a roller connection between said lever and locking means, means for yieldingly moving said lever in one direction, a series of landing-doors, a series of levers placed opposite said doors, a roller and guide placed upon each of said doors and engaging with said levers and a flexible connection secured to each of said levers opposite said doors and to the levers adapted to operate said locking means all substantially as described.

16. The combination of a toothed disk toothed on a portion only of its circumference a pair of pawls placed on either side of said disk, engaging with the teeth thereof, a spring

secured to the said pawls, and tending to bring them into contact with the disk, a lever turning on bearings set between said pawls and having means for engaging with said pawls, yieldingly-acting means for causing the movement of said lever in one direction and means actuated by the opening and closing of the elevator-doors for causing the movement of the said lever in the other direction, substantially as described.

17. In an elevator, the combination with a rotating toothed disk moving positively with the starting and stopping mechanism, of a framework, a pair of pawls set in said framework, and having a portion of their faces cut away, a rocking lever pivoted between said pawls and provided with rollers engaging with said pawls and lying in said cut-away parts thereof when said pawls are in engagement with said toothed disk, landing-doors and mechanism actuated by said landing-doors operating to move said lever in one direction when any of the doors are open and into another position when all of the doors are closed, substantially as described.

18. In an elevator, the combination of a revolving disk moving positively with the starting and stopping mechanism, and having a small portion only of its periphery provided with teeth, pawls engaging with said disk, a framework in which said pawls are set, a weighted lever having bearings between said pawls set in said framework, a landing-door, a lever set opposite said landing-door, and a flexible connection extending between said lever opposite said door and said weighted lever, all substantially as described.

19. The combination in an elevator with a car and a rotating part in positive connection with the stopping and starting mechanism, of a locking device adapted to engage with said part only when said car is substantially stationary, a series of landing-doors, a series of levers opposite said doors, rollers and guides upon said doors engaging with said levers, a lever for operating said locking device, and a flexible connection to each of said levers adjacent to said doors and to the lever operating said locking device, substantially as described.

20. The combination of an elevator-car series of landing-doors, a series of oscillating levers operated positively in one direction by the opening of said doors, means for yieldingly operating said levers in the opposite direction, a locking device for the starting and stopping devices of the elevator, adapted to lock only when the car is substantially stationary a lever adapted to operate said locking device, and a single flexible connection connected to each of said levers opposite the doors, and said lever operating said locking device, substantially as described.

21. The combination in an elevator, with a disk positively connected to the starting and stopping mechanism, said disk being provided at different portions of its circumference with teeth set in opposite directions each set extending over only an arc of said circumference of a pair of pawls, a framework in which said pawls are set, a weighted lever pivoted on said framework, having rollers secured thereto engaging with the faces of said pawls, a spring secured between said pawls, landing-doors and mechanism operated by the opening and closing of the said landing-doors actuating said lever in one direction, when all of the doors are open and allowing it to move into another when all of the doors are closed substantially as described.

22. In an elevator, the combination with a rotating part positively connected to the starting and stopping mechanism, of a pair of pawls adapted to engage with said rotating part, a spring secured between said pawls to one of which one end of said spring is secured, said spring having a screw-stem, a set-screw turning on said stem and bearing against one of said pawls, a lever pivoted between said pawls and having provisions for moving said pawls in the opposite direction to that in which they are moved by the said spring, a landing-door, and mechanism operated by the opening and closing of said landing-door by which said lever is moved in one direction when the door is open and in the other direction when the door is closed, substantially as described.

23. In an elevator, the combination with a disk positively connected with the starting and stopping mechanism of a pair of pawls adapted to engage with said disk only when said car is substantially stationary, a spring secured between said pawls, and acting to bring the pawls into engagement with said disk, a lever pivoted between said pawls, and provided with rollers engaging with said pawls, yieldingly-actuated mechanism operated to move said lever in one direction, a landing-door and positively-actuated mechanism operated by the opening of said landing-door, to move said lever in the opposite direction to that in which it is moved by said yieldingly-actuated mechanism substantially as described.

24. In an elevator the combination of an elevator-car a rotating part positively connected with the starting and stopping mechanism, of a locking device adapted to be moved into and out of engagement with said part only when said car is substantially stationary, a series of landing-doors, a series of levers adjacent to said landing-doors, pivoted at one end and engaging with the said door and a flexible connection attached to said levers between pivot and the part engaging with said door, and extending between said levers and said locking device, substantially as described.

25. In an elevator, the combination with a car a revolving part positively secured to the starting and stopping mechanism of a pair of pawls adapted to be moved into and out of engagement with said part only when said car is substantially stationary, a spring yield-

ingly urging said pawls into engagement with said disk, a lever pivoted between said pawls and provided with rollers engaging with the faces of said pawls, a bed-plate in which said pawls are mounted, a standard rising from said bed-plate to which said levers are pivoted, a guide-piece for said pawls, secured to said standard, landing-doors and means operated by the opening and closing of the landing-doors for controlling the movement of said lever substantially as described.

26. In an elevator, the combination with a part positively connected with the starting and stopping mechanism, a locking device adapted to be moved into and out of positive connection with said part, a yieldingly-acting device for moving said locking device into such positive engagement only when the elevator is substantially stationary, a landing-door, a lever adapted to be operated by said door and connections between said lever and said locking device for causing the locking device to disengage itself from said part when said door is closed, substantially as described.

27. In an elevator, the combination of a rotating part positively connected with the starting and stopping mechanism, a locking device adapted to engage said rotating part positively, and only when the elevator is stationary, a yieldingly-acting device operating to move said locking device into such engagement, a landing-door, and mechanical connections between said door and locking device for causing the locking device to disengage itself from said rotating part when the door is closed, substantially as described.

28. In an elevator, the combination of a locking device, a toothed disk positively connected, with the starting and stopping mechanism, and having teeth set to engage said locking device only at points on the periphery of same that will be opposite the said locking device when the elevator is stopped, yieldingly-acting mechanism for bringing the locking device into engagement with said toothed disk, a landing-door, a lever oscillated by the movements of said landing-door, and connections between said locking device and lever whereby the said locking device is disengaged from said toothed disk when said door is closed, substantially as described.

In testimony whereof I have hereto set my hand this 19th day of March, 1896.

WILLIAM C. FAHY.

In presence of—
GEO. W. REED,
MARK WILKS COLLET.

(No Model.) 3 Sheets—Sheet 1.

E. C. MERRILL & B. J. FOLEY.

AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

No. 595,326. Patented Dec. 14, 1897.

Fig. 1.

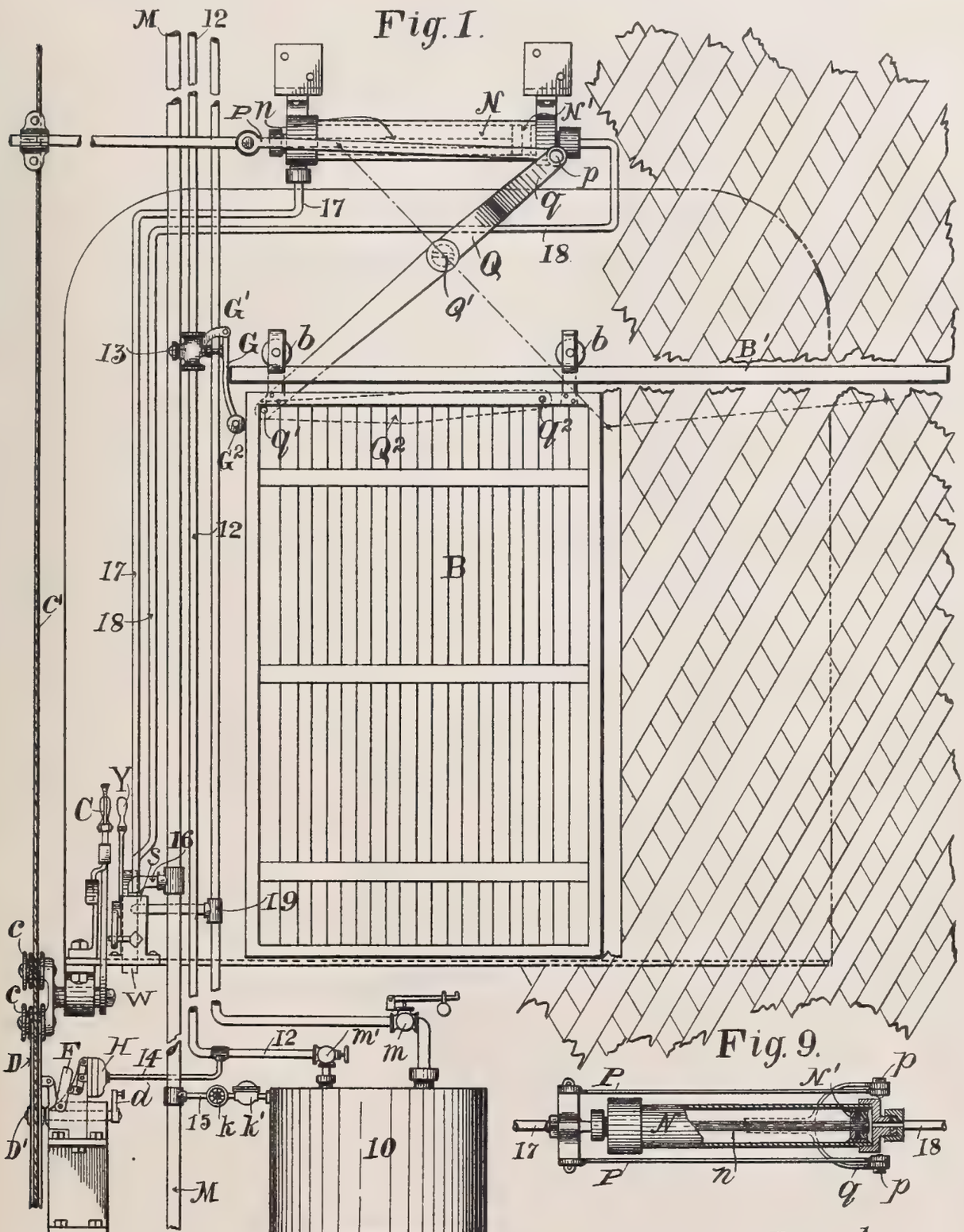

Fig. 9.

Witnesses
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Roger Lewis.

Inventors.
Edwin C. Merrill
Bartholomew J. Foley.
by Pollock & Maund
their attys.

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(No Model.) 3 Sheets—Sheet 2.

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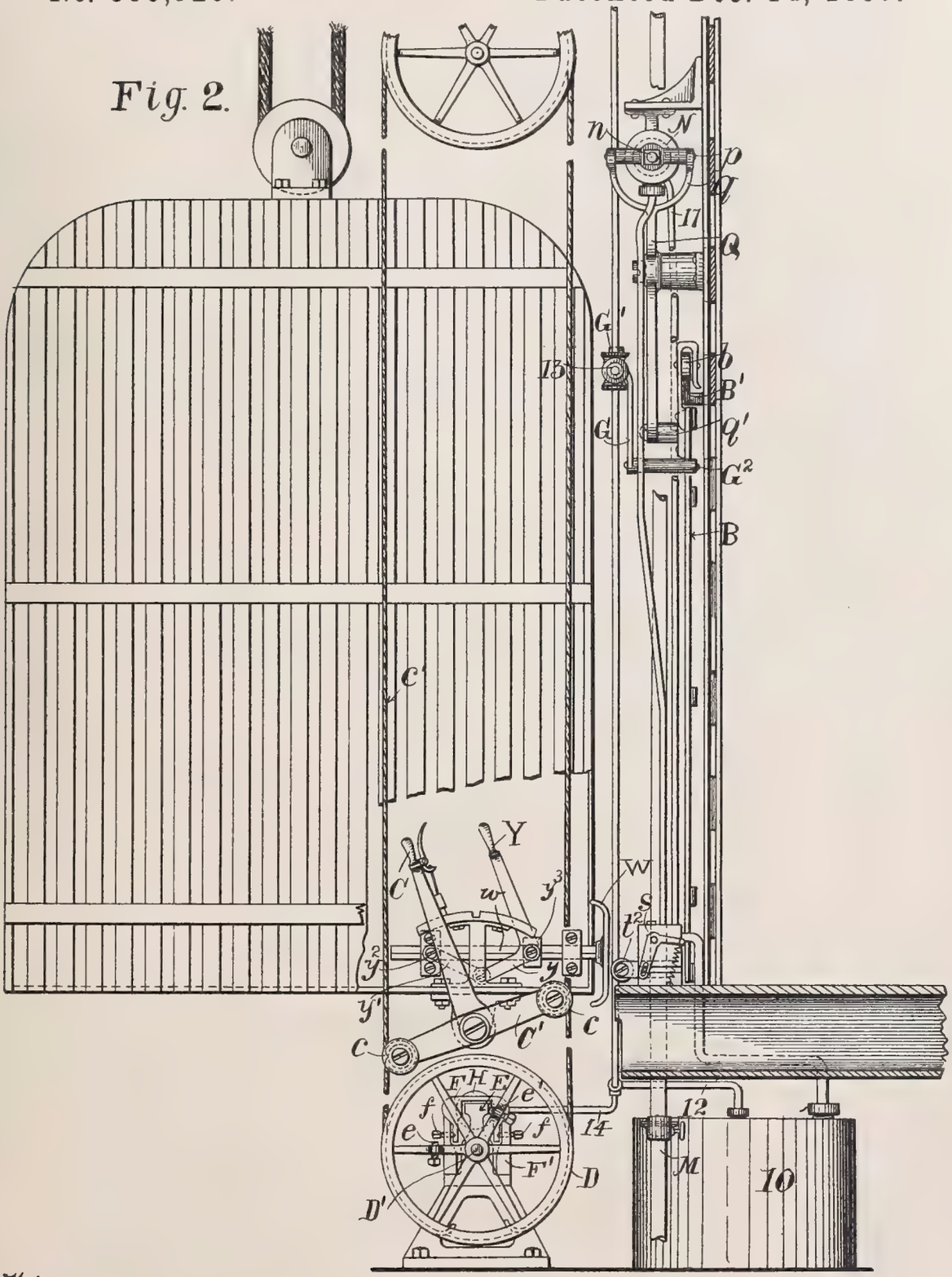
Fig. 2.



Witnesses
W. R. Edelin.
Geo. Lewis.

Inventors.
Edwin C. Merrill
Bartholomew J. Foley
by Pollock & Mauro
their Attys.

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(No Model.) 3 Sheets—Sheet 3.

E. C. MERRILL & B. J. FOLEY.

AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

No. 595,326. Patented Dec. 14, 1897.

Fig. 3.

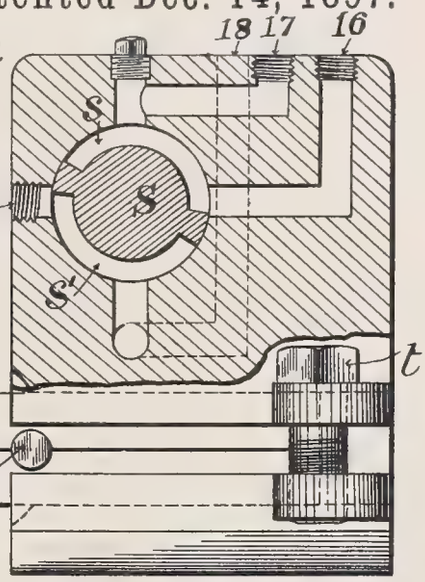

Fig. 4.

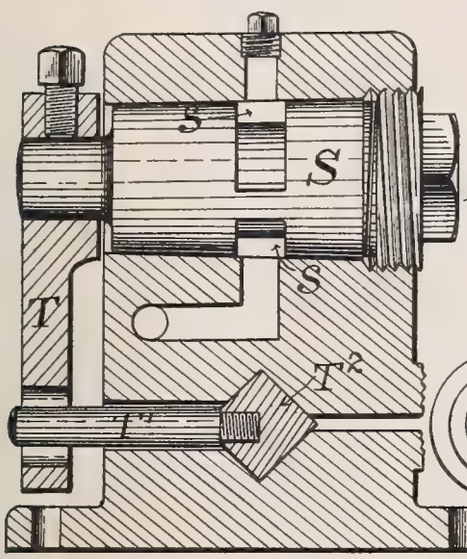

Fig. 5.

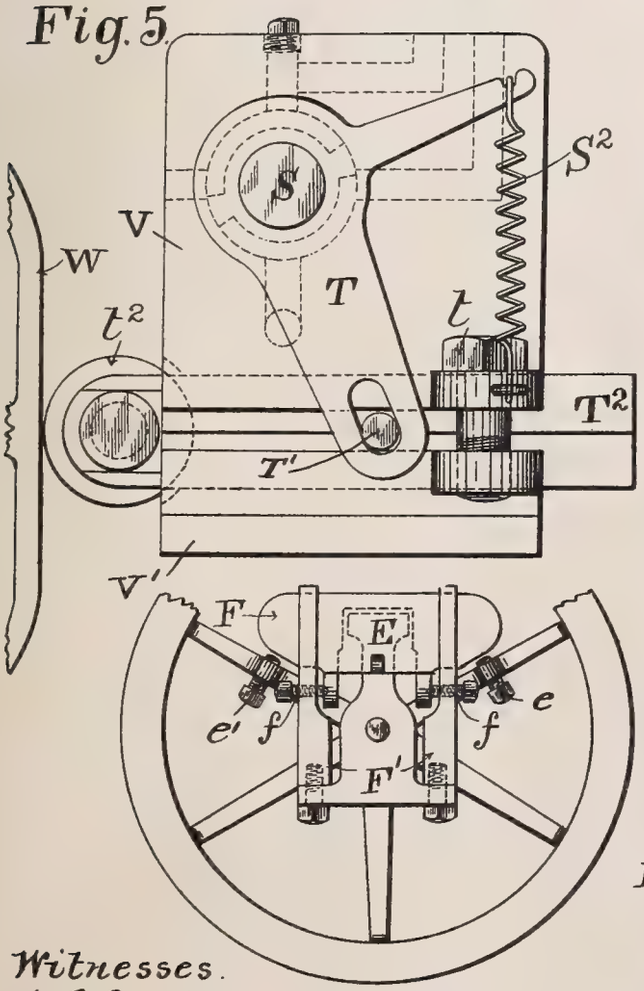

Fig. 6.

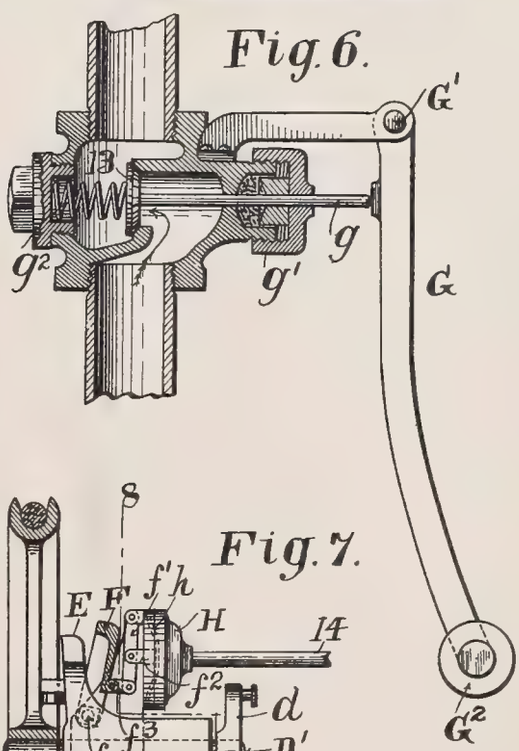

Fig. 7.

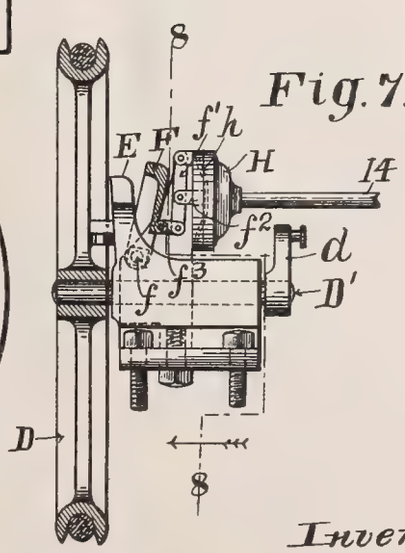

Fig. 8.

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Reeve Lewis

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

EDWIN C. MERRILL AND BARTHOLOMEW J. FOLEY, OF PITTSBURG, PENNSYLVANIA.

AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 595,326, dated December 14, 1897.

Application filed August 22, 1896. Serial No. 603,623. (No model.)

To all whom it may concern:

Be it known that we, EDWIN C. MERRILL and BARTHOLOMEW J. FOLEY, of Pittsburg, Pennsylvania, have invented a new and useful Improvement in Automatic Control Devices for Elevators, which improvement is fully set forth in the following specification.

This invention relates to automatic control devices for elevators; and its first object is to provide means for locking the elevator when any door of the elevator-shaft is opened, so that the elevator cannot move from the floor at which a door has been opened until the latter has been closed. A reliable and simple device for this purpose has been greatly desired as a safeguard against accident, and the legislature of one of the States has required that all elevators be equipped with mechanism for this purpose.

This part of our invention consists in a pneumatic control system or a system operated by compressed air, the object being to insure certainty of action by means of simple mechanism. According to our invention each elevator-door is provided with connections whereby when a door is opened a valve in the compressed-air system is actuated, causing application of the locking mechanism. The locking mechanism and the connections whereby it is actuated may be of many different forms; but it is preferred to apply the stopping device or lock to the elevator-controller.

The invention also has for its object to provide mechanism operated by compressed air whereby the operator can on approaching a floor, by the manipulation of a lever or other device, cause the door of that floor to open. The opening of the door causes the locking of the elevator, as already explained. To start the elevator, the operator first moves the lever to close the door, after which the elevator being released may proceed on its way. The exhaust-air from the door-operating mechanism is utilized to operate the locking mechanism.

The whole system can be most conveniently explained in connection with the accompanying drawings, in which we have illustrated the application of the system to one of the well-known types of elevators in common use. It will, however, be understood that the mechanism or some parts thereof must be modified for application to elevators of a different type.

In the drawings, Figure 1 is a front elevation looking toward one of the doors and the elevator-car. Fig. 2 is a side elevation. Fig. 3 is a section of one of the door-controlling valves and its casing transverse to the axis of the valve. Fig. 4 is a section at right angles to Fig. 3. Fig. 5 is an end elevation of the valve and its actuating mechanism. Fig. 6 is a sectional detail of one of the lock-controlling valves. Fig. 7 is a section, partly in elevation, of the governor-wheel and the locking mechanism. Fig. 8 is a sectional elevation on line 8, Fig. 7; and Fig. 9 is a sectional plan of part of the door-operating mechanism.

We have shown the mechanism for one floor only of the building, and it will be understood that each floor will be equipped with mechanism similar to that shown.

In the drawings, A represents an elevator-cage, and B a door on one of the floors.

The mechanism for starting, stopping, and reversing the elevator is of ordinary construction and will require but a brief description.

C is the operating-lever in the car. It may occupy any one of three positions. In that indicated in Fig. 2 the car is supposed to be moving downward. This lever controls a shifting beam C′, having on each end a roller *c*. The guide-rope *c′* is looped around each of these rollers and at its lower end passes around the controller-wheel D. The latter is on a shaft D′, which has at one end a crank arm or tappet *d*, which is connected with the valve of the hydraulic elevator mechanism in the usual way. This mechanism forms no part of the invention and therefore is not illustrated. It suffices to state that in one extreme position of tappet *d* the elevator is moving upward, in the other it is moving downward, and in the intermediate position it is brought to rest. The bearing of shaft D′ carries in the rear of wheel D an upright abutment E, and wheel D has on its rear side two stop-screws *e e′*, which by contact with abutment E limit the movement of

the wheel D. As seen in Fig. 2, the wheel D is in one of its extreme positions, screw e' being in contact with abutment E.

F represents the locking-piece, pivoted at f to a supporting-frame F′ and hollowed out so that it can embrace the abutment E when thrown into its locking position. When in that position, (shown in Fig. 8,) it is in the path of the stops e e', and so prevents the movement of the wheel. It will be observed that locking-piece F can only be thrown into its operative position when wheel D is in its intermediate position—that is to say, when the car is at rest. Now the result to be accomplished by this part of the mechanism is to throw the lock into action by the opening of the door B. When the apparatus is constructed as shown in the drawings, this is accomplished in the following way: A suitable tank or reservoir 10 contains air at a moderate or low pressure. One pound above atmospheric pressure has been found sufficient. Suitable means for supplying air to reservoir 10 and regulating the pressure therein are provided, as will be presently shown. From reservoir 10 is led a discharge-pipe 12, which passes up the elevator-shaft and is open to the atmosphere at its upper end. Adjacent to each door B is a valve 13, which is normally open. Consequently under normal conditions—that is, when all the doors are closed—there is a current of air passing through pipe 12 and escaping at its end. Valves 13 are all controlled by the doors B, the valve being held open when the door is fully closed and closed when the door is opened. The valve-actuating mechanism is shown in Fig. 6. The stem g of the valve 13 projects through and beyond the stuffing-box g', and its outer end is in contact with an arm G, pivoted at G′, and having at its lower end a roller G^2. When door B is closed, the side of the door-frame presses on roller G^2 and tilts arm G sufficiently to lift valve 13 off its seat against the pressure of spring g^2. As soon as door B moves in the direction to open it spring g^2 closes valve 13, as shown in Fig. 6. Consequently the pressure accumulates in pipe 12, and this will occur whenever any door of the system is opened. From pipe 12 a branch pipe 14 leads to a casing H, containing a flexible diaphragm h, which actuates the lock F. As shown in Fig. 7, the parts are in their normal position. Lock F is connected by a link f^3 with a lever f', which amplifies the movement of diaphragm h, to which it is connected by a link f^2. As soon as the air being cut off by the closing of one of the lock-control valves 13 accumulates behind diaphragm h the latter is forced outward, setting the lock and holding it in that position until the control-valve is opened, which does not occur until the door is fully closed.

It will be readily seen that the principle embodied in the mechanism just described of causing compressed air controlled by the movement of a door to lock and unlock the hoisting mechanism may be carried out in many different ways.

M represents the main air-supply pipe. As shown in Fig. 1, a branch pipe 15 connects the main with reservoir 10. In this branch are a stop-cock k and a pressure-reducing valve k'. This branch is used for filling the reservoir initially and to maintain the pressure therein in case of deficiency in the normal source of supply, which, as will presently be shown, is the exhaust-air from the door-operating cylinders. A safety or blow-off valve m is provided to prevent excess of pressure in tank 10, and pipe 12 has a leak-valve m' set to permit the desired amount of air to pass.

We will now describe the mechanism for automatically opening and closing the doors. Above each door and supported from the ceiling or otherwise is a cylinder N, in which is a double-cupped piston N′. The projecting end of piston-rod n is secured to the cross-bar of a rectangular frame P, the side bars of which embrace the cylinder N, and which is reciprocated by piston-rod n. To the end of frame P, opposite the piston-rod, is jointed by pivots p a yoke q, which is at one end of a lever Q, which is pivoted at Q′. At its end q' lever Q is jointed to link Q^2, which in turn is pivoted to door B. The latter is suspended, as usual, by rollers b from rail B′. Obviously, through the connections just described, the movements of piston N′ will be transmitted to the door to open and close the same. It is also obvious that various mechanical connections may be substituted for those described. In the position of the parts shown in Fig. 1 the door B is closed. Piston N′ is controlled by a valve S, there being, of course, one valve for each door. For convenience these valves will be termed the "door-control valves." Figs. 1 and 2 indicate the positions of these valves and the connections of the piping, and Figs. 3, 4, and 5 illustrate in detail the valve and its actuating devices. The main air-pipe M has a branch 16 to each valve. The pressure in this pipe must be high relatively to that in the tank 10 and its connected pipes. We have found that a pressure of fifteen pounds above atmospheric pressure gives good results. From valve S two pipes 17 and 18 lead, respectively, to opposite ends of cylinder N. When main M is connected with pipe 17, the pressure will be exerted on piston N′ on the side to close the door, and when connected with pipe 18 the piston will be reversed and the door opened. A fourth pipe 19 leads from valve S to tank 10. This is the exhaust-pipe, so that the exhaust-air from cylinders N goes to supply the low-pressure reservoir.

In Fig. 4 the relation of the valve to the different ports it controls is shown, and to facilitate understanding of the operation

the several air-passages in the valve-casing are designated each by the numeral of the pipe with which it connects. Passage 16 connects with the branch to main M, passage 17 leads to the door-closing side of piston N′, passage 18 leads to the door-opening side of said piston, and passage 19 leads to tank 10. Valve S has two grooves or channels *s s′*. Groove *s* connects the air-inlet 16 with one of the pipes 17 or 18, leading to cylinder N, while groove *s′* connects the other pipe with the exhaust-port 19. In the position shown in Fig. 4 the inlet 16 is connected with the door-closing end of cylinder N, while the other end is in connection with the exhaust. A slight turn of valve S on its axis will reverse these connections and cause the door to open. It will be observed that by the operation of the valve S not only is the door opened and closed, but it is locked in each of these positions until the valve is shifted.

The valve-shifting mechanism may be variously constructed. As shown, the valve-spindle has a crank-arm T, connected by a pin T′ with a bar T^2, arranged to slide in grooves between two parts V V′ of the valve-casing. These parts are fastened together by screw-bolts *t*, by means of which wear may be taken up. On its projecting end bar T^2 carries a roller t^2. This roller occupies such a position that it may be acted upon by a shoe W, carried by the elevator-car and under control of the operator therein.

Y represents the operating-handle, Fig. 2, in the form of a bell-crank lever. Its short arm is jointed at *y* to a link *y′*, pivoted to a fixed support at y^2. Lever Y is jointed at y^3 to the stem *w* of shoe W, and its short arm forms with link *y′* a toggle. In the normal position (shown in Fig. 2) shoe W will just clear roller t^2 on passing it. When the operator wishes to open a door, he throws lever Y to the right, moving shoe W into the path of roller t^2. Bar T^2 will consequently be moved to the position shown in Fig. 5, shifting valve S and opening the door. Lever C having been brought to its central position to stop the car, lock F is automatically applied, preventing further movement of the car until the door is closed. To accomplish this, lever Y is moved back to its first position, whereupon spring S^2 restores valve S and the door is closed by the air-pressure. Every time this operation is performed the exhaust-air from cylinder N passes to reservoir 10.

Manifestly the apparatus for automatically locking the elevator and that for opening and closing the doors could each be used independently of the other; but to accomplish the full object of the invention the system as a whole must be used.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The combination of the controller-wheel carrying two stops, an abutment coöperating with said stops to limit the movement of the wheel, a locking-piece movable between said stops when the wheel is in a central position, and pneumatic actuating mechanism for said locking-piece operated by the opening of a door in the elevator-shaft, substantially as described.

2. In an elevator system, the combination with a door of the elevator-shaft, and with a lock for the hoisting mechanism, of devices actuated by compressed air for opening and closing the door, means for operating said devices from the car, and mechanism, operated by the exhaust-air from door-operating devices, for actuating said lock, the lock-actuating mechanism being controlled by the position of the door, substantially as described.

3. In an elevator system, the combination with an elevator-door, of a lock for the hoisting mechanism, pneumatic mechanism for operating said lock, a low-pressure tank and piping for supplying air to said mechanism, a lock-control valve operated by the door, pneumatic mechanism for opening and closing the door, comprising a cylinder, a piston connected with the door, and a door-controlling valve, a supply-pipe leading to the valve, an exhaust-pipe leading from said valve to said low-pressure tank, and means for regulating the pressure in said tank, substantially as described.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

EDWIN C. MERRILL.
BARTHOLOMEW J. FOLEY.

Witnesses:
WM. K. GRAY,
WM. C. CHARLTON.

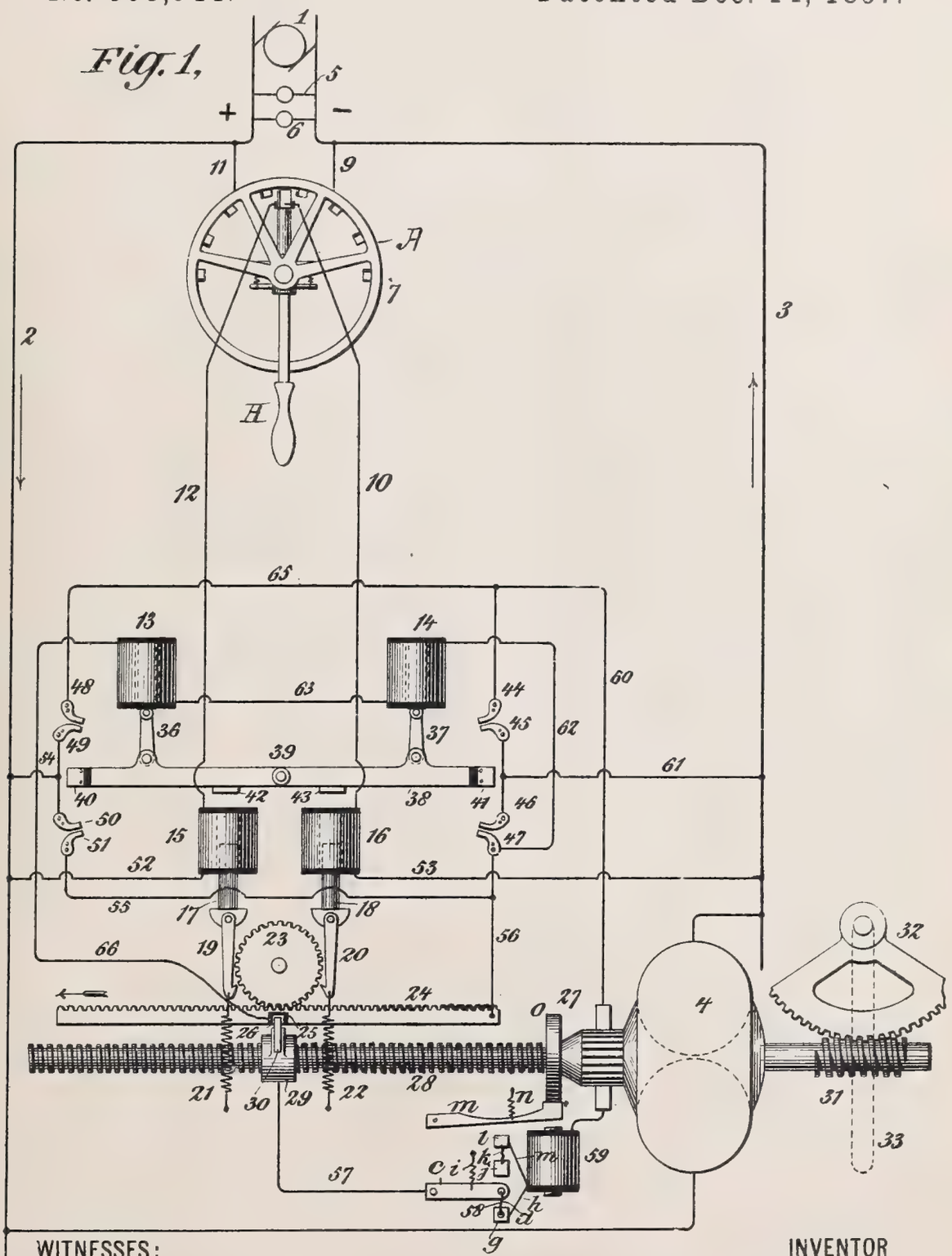
(No Model.) 3 Sheets—Sheet 1.

F. J. RUSSELL.

CONTROLLING DEVICE FOR ELECTRIC MOTORS.

No. 595,344. Patented Dec. 14, 1897.

Fig. 1,



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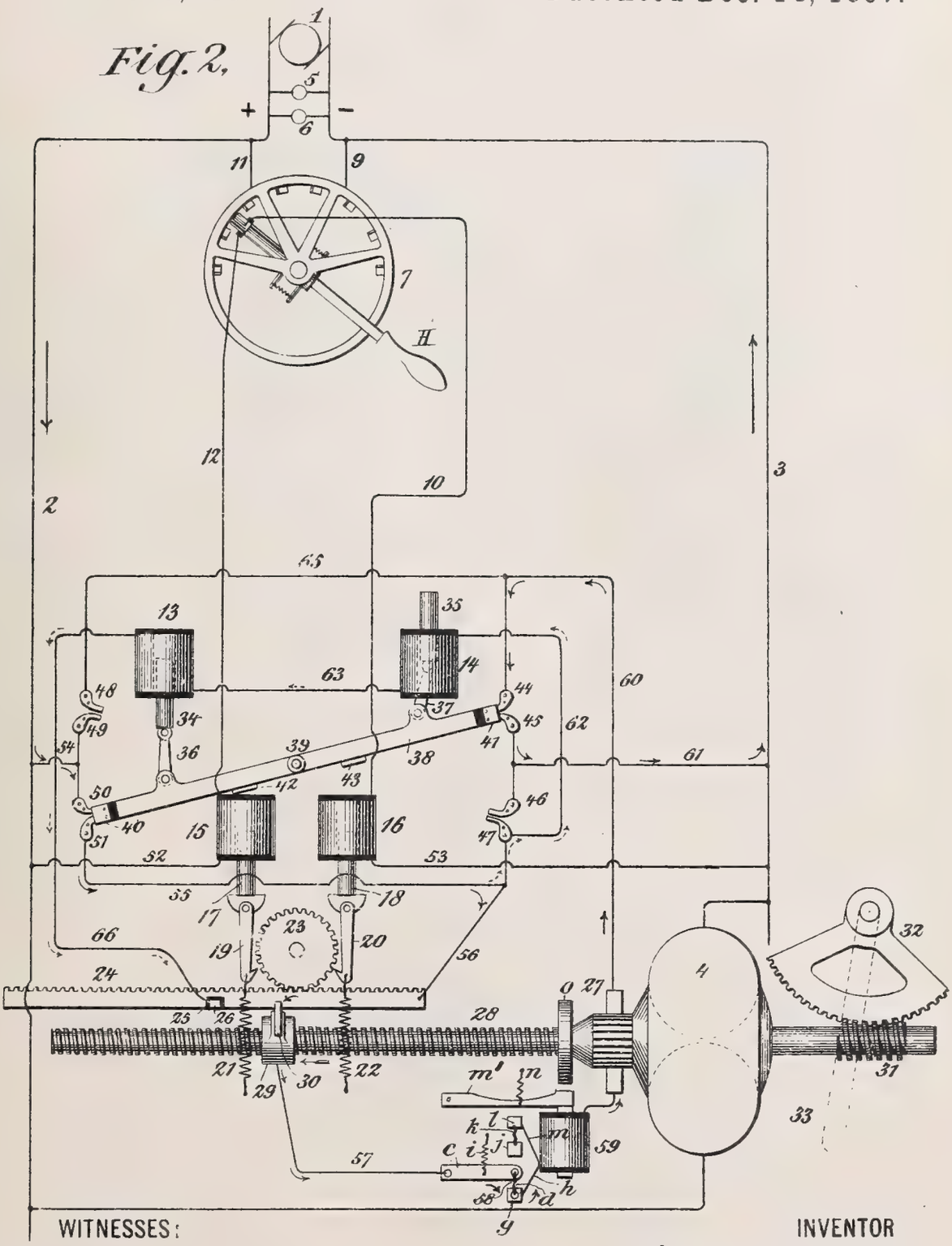
(No Model.) 3 Sheets—Sheet 2.

F. J. RUSSELL.

CONTROLLING DEVICE FOR ELECTRIC MOTORS.

No. 595,344. Patented Dec. 14, 1897.

Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

F. J. RUSSELL.

CONTROLLING DEVICE FOR ELECTRIC MOTORS.

No. 595,344. Patented Dec. 14, 1897.

Fig. 3.

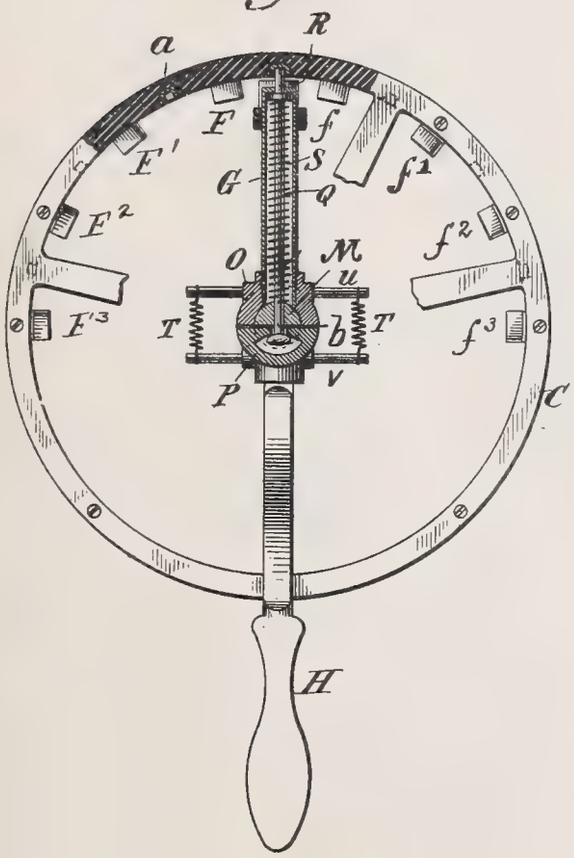


Fig. 4.

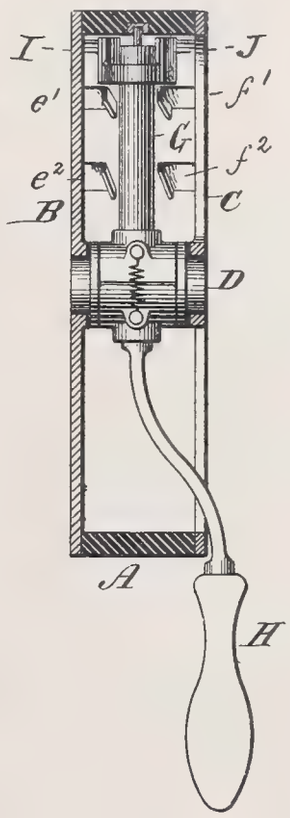
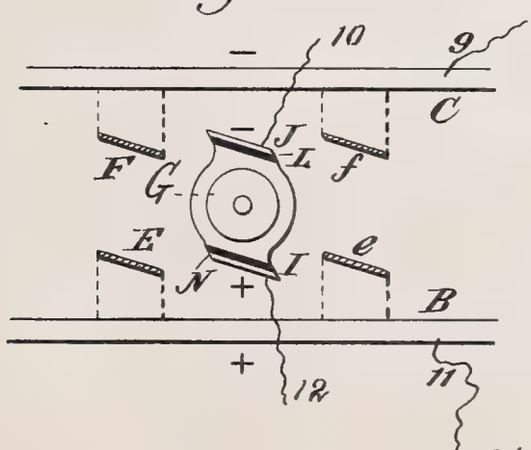


Fig. 5.



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UNITED STATES PATENT OFFICE.

FRANK J. RUSSELL, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO HORACE SEE, OF SAME PLACE.

CONTROLLING DEVICE FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 595,344, dated December 14, 1897.

Application filed April 22, 1897. Serial No. 633,224. (No model.)

To all whom it may concern:

Be it known that I, FRANK J. RUSSELL, of the city, county, and State of New York, have invented a new and useful Improvement in Controlling Devices for Electric Motors, of which the following is a specification.

The object of my invention is to provide electrical means for controlling electric motors when applied to conditions where accuracy and certainty of control, both in point of direction of motion and extent of motion, is of especial importance. Such conditions are present when electric motors are applied to the turning of turrets on war-ships, or the moving of rudders or guns, or signal apparatus of any kind, or in hoisting or lowering weights, such as elevators.

My invention consists in the method of controlling electric motors and also in the apparatus for carrying said method into effect, which apparatus is the best means which I now know for the aforesaid purpose.

The principle of my invention is to exercise the necessary control upon the motor in such a way as that such control shall not depend for its efficiency on the maintenance of constant voltage necessary for the driving of the motor or other translating device which may be in the circuit, so that no matter how much the electromotive force on the mains may fluctuate beyond the limit necessary for the operation of my device the said operation shall be entirely independent of such fluctuations.

Inasmuch as my apparatus is readily constructed to operate at a very low voltage it follows in practice that it is independent of any and all fluctuations likely to occur in a circuit including such translating devices as motors or lights.

My apparatus is constructed so that the movement of the manipulating-lever introduces into the motor-controlling device a series of current-impulses of substantially uniform strength. If the lever is moved in one direction, these impulses have a corresponding direction. If it is moved in the other direction, the direction of the impulses is reversed. The number of impulses depends upon the extent of deviation of the lever. The construction is also such that the unweakened current of the mains comes to the controlling device, and as the lever passes over its successive contact-plates to produce successive impulses the movement of the lever does not throw in or take out resistances, or, in other words, the strength of the current is not impaired in any wise in proportion to the extent of movement of the lever, as in most devices where the extent or period of movement of the motor depends upon the extent of deviation of the manipulating-lever. It will further be observed that I accomplish this result without the use of any multiple system of wiring.

In the accompanying drawings, Figure 1 shows, diagrammatically, the apparatus and the relation of the parts when at rest. Fig. 2 is a similar view showing the relation of the parts at the time that the motor is operating. Fig. 3 is a view in plan and partial section of the manipulating device, which is governed by the hand of the operator. Fig. 4 is a transverse section of the same. Fig. 5 is a diagram illustrating the manner in which the contact-arm of the manipulating device shown in Figs. 3 and 4 makes circuit with the plates arranged in said manipulating device for the purpose of governing the motor. The observer is supposed to look radially outward from the center on which said contact-arm turns.

Similar numbers and letters of reference indicate like parts.

Referring first to Fig. 1, 1 is the dynamo or other source of electricity, which is here shown with its brushes in direct circuit by the conductors 2 and 3 with the field-coils of the motor 4. The conductors 2 and 3 may be those used for supplying an electric-lighting system, as shown by the diagrammatic illustration of lamps at 5 and 6. The conductor 2 is here supposed to be a plus conductor and the conductor 3 a minus one.

I will first describe the manipulating device, which is shown at 7 in Figs. 1 and 2 and illustrated in detail in Figs. 3, 4, and 5. This consists of a hollow cylindrical case A, of insulating material, having at its ends spiders B C, of metal. Extending inward from the spider B are inclined spring contact-plates E E′ E^2 E^3 and *e e′* e^2 e^3. Extending inward from the spider C are similar inclined spring

contact-plates F F′ F² F³ and *f f′ f² f³*. The contact-plates on spider C are disposed opposite to the contact-plates on spider B, and the opposing faces of said plates are substantially parallel, as shown in Fig. 5. Said plates may be, if desired, disposed at regular intervals circumferentially around the spiders.

G is a contact-arm journaled at D in the spiders and provided with a handle H. Said arm carries at its end two contact-plates I and J, which are inclined with their faces respectively substantially parallel to the faces of the series of plates E *e*, &c., and F *f*, &c., as seen in Fig. 5. The plates I and J are covered with insulating blocks or screens L N on their inner faces.

The spider B is connected by conductor 11 with the plus main conductor 2 and the spider C by conductor 9 with the minus main conductor 3. The plate J is connected to circuit-wire 10 and the plate I to circuit-wire 12.

Assume now that the handle H, Fig. 3, is moved to the left, carrying the contact-plates I J on the arm G to the right of Fig. 5. Then the contact-plate J will pass beneath and make contact with the plate *f* on spider C, thus establishing circuit from the minus main conductor 3 through conductor 9 to conductor 10. The contact-plate I will pass beneath contact-plate *e* on spider B, but will be prevented from establishing circuit by the insulating block or screen N, which comes between said plates I and *e*. As the plates *f* and J are both of considerable width, electrical circuit is maintained over the period during which they remain in contact and until the plate J passes beyond and to the right of plate *f*.

If the handle H, Fig. 3, be moved to the right instead of to the left, then the plate J will pass over the plate F and be prevented from closing circuit therewith by the insulating-block L, but the face of plate I will meet the plate E, and thus circuit will be closed through the plus main conductor 2, conductor 11, spider B, and plate E, plate I, and conductor 12. Consequently when the handle H is turned to the left circuit is established through the apparatus with the minus conductor 3 as contact is made between plate J and each successive plate *f f′ f²*, &c., and the duration of the closing of the circuit will be governed by the width of the respective plates. On the other hand, when the handle H is turned to the right circuit in like manner is established with the plus conductor 2 as contact is made in like manner between plate I and each successive plate E E′ E², &c.

Now assume that the plates J I have been carried to the right of Fig. 5 and beyond the plates *e f* and that they are to be returned to their original middle position, moving to the left. Then the plate I will establish contact during its return journey with the plate *e* by moving over said plate, while the plate J, moving over plate *f*, will be prevented from closing circuit with said plate by the insulating-block L. Similarly, if the plates J I have been carried to the left of plates F E and are to be returned to middle position, moving to the right, then plate J will establish circuit through plate F, while plate I, passing also beneath plate E, will be insulated therefrom by block N.

The net result is as follows: Assuming arm G to be in its middle position, as shown in Fig. 3, if said arm be moved to carry plates J I to the right and beyond plates *e f* then circuit is established between plates J and *f* to minus conductor 3 and wire 10. When said arm is moved to the left to return it to its original position, circuit is established between plates I and *e* to plus conductor 2 and wire 12. When said arm G is moved from its original position to carry plates J I to the left and beyond plates F E, then circuit is established between plates I and E to plus conductor 2 and wire 12. When said arm is moved to the right to return it to its original position, then circuit is established between plates J and F to minus conductor 3 and wire 10; or, more briefly, original movement of plates J I to the right establishes minus connection through the apparatus as each plate *f f′*, &c., is successively passed over, and movement back again to the left establishes a succession of plus connections through plates *e e′ e²*, &c. Movement originally to the left establishes plus connection as each plate E E′ E² E³ is traversed, and movement back again to the right establishes successive minus connections as the plates F F′ F², &c., are passed over.

Reference to other details of the manipulating device may be deferred until other parts of the general apparatus are explained.

13, 14, 15, and 16 are electromagnets, each having a plunger-shaped core, (indicated in Fig. 1 in dotted lines 13 and 14 and shown partly protruding from the solenoids 15 and 16 at 17 and 18.) The cores 17 and 18 are vertically disposed and carry pivoted engaging pawls 19 and 20. Connected to pawls 19 and 20 are retracting-springs 21 and 22. The pawls 19 and 20 are placed so as to engage with the teeth of a toothed pinion 23. The teeth of this pinion also engage with the teeth of a sliding rack 24. On the rack 24 is an insulating-block 25, which carries a metal contact 26.

27 is the armature of the motor 4. The shaft of said armature is threaded at 28 and carries the nut 29, provided with a sliding finger 30, which finger, when the position of the parts is as shown in Fig. 1, bears against the metal contact 26 on rack 24. The motor-shaft on the other side of the field-magnets may be screw-threaded, as shown at 31, in order to engage with the sector-rack 32, and thus impart motion to the thing to be governed or controlled by the motor—as, for example, a rudder, indicated by dotted lines 33, of which 32 would then be the tiller; or 33 may represent the valve-rod of a steering-engine actuated by the sector 32. The

cores of magnets 13 and 14 (indicated by dotted lines in Fig. 1 and shown protruding from the solenoids at 34 and 35, Fig. 2) are connected by links 36 and 37 to a lever 38, which is centrally pivoted at 39. The lever 38 carries at its ends contact-pieces 40 and 41, which are insulated, as shown, from the body of the lever. The lever 38 also carries metal plates 42 and 43, which are armatures to the solenoids 15 and 16. The ends 40 and 41 of the lever 38 are adapted to close contact between the pairs of fixed contact-plates 44, 45, 46, 47, 48, 49, 50, and 51.

The arrangement in circuit and operation of the parts thus far named is as follows: Assume the handle H to be moved to the right, so carrying plates J I to the left of Fig. 3 and meanwhile establishing plus connection, already explained by the sweeping of plate I over and in contact with plate E. Shunt-circuit is then established through wire 12, solenoid 15, wire 52, to main conductor 2. Solenoid 15 then draws up its core 17 and pawl 19, so that toothed pinion 23 is rotated to the right and rack-bar 24 moved to the left. Through the movement of bar 24 circuit is broken between finger 30 and contact-plate 26 and established between finger 30 and the body of the bar 24, as shown in Fig. 2. The solenoid 15 also attracts its armature 42 on pivoted lever 38, tilting said lever, as shown also in Fig. 2, and causing it to close circuit between the pairs of plates 50 and 51 and 44 and 45. The circuit then established is as follows: from main conductor 2 by wire 54, through plates 40, 50, and 51 to wire 55, by wire 56 to bar 24 to finger 30, by wire 57 through fuse 58 and electromagnet 59 to and through the motor-armature, then by wire 60 to contact-plates 41, 44, and 45, and thence by wire 61 to the minus main conductor 3. The motor is thus set in operation, rotating in definite direction, and the period of its operation will depend upon how many contact-plates E E′, &c., have been passed over by the plate I, or, in other words, upon the extent of movement of the handle H. The passage of plate I over each contact-plate in turn produces the result above stated—that is to say, if one contact-plate E is passed over then the bar 24 is moved to the left a certain distance and a certain space on the bar intervenes between contact-plate 26 thereon and finger 30. If two contact-plates E E′ are traversed, then the bar moves twice as far (two impulses) and double the aforesaid space intervenes, and so on; but as soon as the motor begins its rotation the nut 29 begins to travel on the screw 28 in a direction toward contact-plate 26 until finally the finger 30 on said nut once more establishes contact with said plate 26. The transverse width of the contact-finger 30 is greater than the width of the insulating material surrounding the contact-plate 26, so that the forward edge of contact-finger 30 establishes contact with plate 26 before the rear edge leaves contact with the bar 24. Therefore there is no break of circuit at any time by the finger in moving from the body of bar 24 to contact-plate 26. When the finger rests wholly on the plate 26, the circuit that is then formed proceeds as follows: from the plus main conductor 2 by wire 54 to contact-plates 40, 50, and 51, wire 55, wire 62 to solenoid 14, wire 63, solenoid 13, wire 66, contact-plate 26, wire 57, and the armature of the motor to wire 60, contact-plates 41 44 45, wire 61, and minus conductor 3. The effect of the current energizing the solenoids 13 14 is to cause them at once to draw their cores into a central position, as shown in Fig. 1, thus bringing the pivoted bar 38 into a position intermediate between the pairs of contact-plates and closing circuit through no pairs. Current is thus broken in the armature-circuit of the motor, and the motor stops, this stoppage being assisted by the action of the friction-brake controlled by the electromagnet 59, which I will describe farther on.

The operation of the motor, now concluded, has, through the worm-screw 31, actuated the rack-sector 32, which, as I have said, may be a tiller, and in this way has set the rudder in definite position, and in that position the rudder remains as long as may be desired.

Suppose now that it is desired to alter the position of the rudder. If it is to be turned still farther in the same direction in which it has already been moved, then the handle H is moved still farther to the right, causing the contact-plate I on the arm G to meet the other plates *e e′*, and the same operation already described is repeated. If, however, it is desired to return the rudder to its original position, then it may be assumed that the handle is carried to the left, and, as already explained in this case, the plate J, communicating with the minus conductor 3, moving to the right of Fig. 5, will establish contact with the plates F F′, &c., and the effect will then be as follows: Current being established between the minus conductor 3 and the wire 10, the solenoid 16 is energized and is in circuit with the minus conductor through the wire 53. It will then draw up its core 18 and lift the pawl 20, which, engaging with the toothed pinion 23, will rotate that pinion to the left, and so move the rack-bar 24 to the right. The contact-plate 26 will thus be displaced now to the right of the finger 30 instead of to the left, as before, although it will, as before, establish circuit through the bar 24. At the same time the solenoid 16 will attract its armature 43, thus tilting the pivoted lever 38 to establish contact between the pairs of contact-plates 48 49 46 47. The parts being thus arranged, the circuit proceeds as follows: from plus conductor 2 by wire 54 to contact-plates 40 48 49, through the wire 65 to the armature of the motor 4, thence through the electromagnet 59 and fuse 58 to wire 57, to finger 30, to bar 24, by wire 56 to contact-plates 41 46 47, and thence by wire 61 to the minus conductor 3. It is obvious that

the current then passes to the motor-armature in a reverse direction to what it did before, and therefore the motor rotates in the opposite way, now carrying its nut to the right until contact is again established between the plate 26 and the finger 30. The circuit thus formed proceeds as follows: from plus conductor 2 by wire 54 around by the path already stated to finger 30, and thence by wire 66 to solenoid 13, by wire 63 to solenoid 14, by wire 62 to contact-plates 40 46 47, and thence by wire 61 to the minus conductor 3. The two solenoids 13 14 then act as before, bringing the lever 38 into a central position and breaking circuit through the armature of the motor and causing it to stop, as previously described. If now it be desired to rotate that armature still farther in the same direction, or, in other words, to set the rudder at a greater angle in the same direction, the handle H is moved still farther to the left to make contact with other plates in the manipulating device, but if it be desired to bring the parts back to their original and central position then the plate I in returning establishes a plus connection through the plate *e* of Fig. 5, thus completing the circuit through the wire 12 and through the solenoid 15 and wire 52 to plus main conductor 2. Solenoid 15 then draws up its core 17, and the pawl 19, engaging with the toothed wheel 23, turns it to the right, moving the bar 24 to the left, and so bringing contact-plate 26 once more in circuit with finger 30, but by reason of the energizing of the solenoid 15 it has attracted its armature 42, thus tilting the lever 38 once more into the position shown in Fig. 2. Then the current proceeds from plus main conductor 2 through the wire 54, through the contacts 40, 50, and 51 to wire 55, wire 62 to the solenoids 13 14, by wire 63 to solenoid 13, by wire 66 to contact-plate 26 to finger 30, wire 57, fuse 58, magnet 59, armature of the motor, wire 60, contact-plates 41 44 45, wire 61, and so to the minus main conductor. The solenoids 13 14 then act, as already described, to centralize the bar 38 and break contact through the armature-coils of the motor, as before, thus once more stopping the motor.

From the foregoing it will be seen that when the handle H of the manipulating device is moved in one direction, no matter from what point it starts, the motor always rotates in a given direction, and when it is turned in the opposite direction the motor always rotates in the relatively opposite direction to what it rotated before, or, in other words, the motor follows the deviation of direction of movement of the handle-bar H. If, for example, in moving, say, to the right only one of the fixed contact-plates of the manipulating device is swept over, then the motor will move in a definite direction only to a certain extent. If the handle be returned immediately to its original position, the motor will rotate backward exactly to the same extent and assume its original position. If in the first instance two contact-plates are passed over, then the motor will rotate in a determinate direction twice as far as before. If in turning the handle backward only one plate is passed over, the motor will rotate backward only half as far, or if two plates are passed over then it will rotate backward a distance equal to that it has rotated forward, so that no matter where the starting-point of movement may be the extent of rotation of the motor in either direction will always depend upon the number of contact-plates that are swept over successively by the contact-plates on the end of the arm.

I desire to call especial attention here to the fact that in this manipulating device there are no resistance-coils or similar devices which are thrown into the circuit by the movement of the plates J and I from one fixed contact-plate to the other, but that, on the contrary, at every contact the same unweakened current on the mains is transmitted to the controlling-solenoids 15 and 16. Therefore the strength of the current on the controlling-circuit does not vary with the position of the controlling-handle or with the number of positions in which that handle may be placed. All that is required, therefore, is that the current shall have sufficient strength to energize the solenoids 15 and 16 to enable them to operate their pawls and turn the wheel 23 and so move the bar 24, and for this purpose only a very small current is required, so that any current which normally exists on lighting-mains will be abundantly sufficient for this purpose, no matter how much it may fluctuate for lighting purposes and practically no matter how much it may fluctuate at the dynamo, provided it does not become at the source diminished to an extent too great to enable it to control the solenoids; or, to put it another way, the controlling electrical mechanism here does not depend for its efficiency upon the maintenance of the constant superior voltage necessary for other translating devices in the circuit. This is an extremely important point to be considered in this invention, and is, so far as I know, here accomplished for the first time in the art without the use of a multiple system of wiring involving an independent conductor from each point of contact in the manipulating apparatus. In this respect, therefore, my invention is radically distinguished from all motor-controlling devices which depend upon or are influenced by the variations of electromotive force within the ordinary limits existing on main conductors.

By constructing the solenoids 15 and 16 so as to have an ample margin of tilting power the whole device is rendered independent of fluctuations in the translating device for producing light on the main circuit or fluctuations in voltage at the dynamo, and such construction of solenoids is within the ordinary knowledge of the skilled electrical workman at this time.

I will now refer to certain details of the apparatus designed to improve its efficiency and the certainty of its working.

Referring first to the manipulating device, Figs. 3, 4, and 5, the middle portion of the journal D, which passes through the hub of the handle, is semicircular, as shown at M in Fig. 3. The hub is made in two parts, one of which, O, is received upon the convex side of said semicircular portion of the journal. The other half, P, of the hub is loose and rests against the flat side of the journal and the edges of the part O, as shown in Fig. 3. The part P of the hub is hollow internally, and in this hollow portion is a headed rod Q, which extends through an opening in the flat side of the part P, through a hole in the middle of the journal D, through the hollow arm G, and protrudes beyond the end of said arm. On the rod Q is a collar R, and between this collar and a portion of the journal D there is a spiral spring S, encircling said rod, the collar operating to hold the end of the rod Q protruding beyond the end of the arm S. The two parts O and P of the hub are held together by the springs T, which extend between arms *u* and *v*, protruding from said parts. In the inner periphery of the casing A are recesses, as *a*, which are placed in midway positions between the successive contact-plates on the spiders.

The operation of the device thus described is as follows: Assuming the parts to be in the position shown in Fig. 3, when the handle H is turned to the right in operating the device the first effect is to move the part P of the hub independently, so that it tends to turn on a center *b* on the right-hand side of said semicircular portion P. This is permitted by the yielding of the spring T, which connects the parts of the hub together. As the handle is moved still farther to the right the part P of the hub engaging with the head of the rod Q operates to draw that rod inward and against the action of the spiral spring S, so that after the handle H has moved a determinate distance—that is to say, to a distance equal to the distance intervening between the position of the recess in which the end of the rod Q is represented in Fig. 3 to the next recess *a* on the left—then the rod Q will have been drawn entirely out of the recess in which it rests, and by the controlling action of the spring T on the left-hand side of the hub connecting its parts together the arm G will be drawn rapidly past the contact-plate on the left-hand side until the end of the arm Q comes opposite the recess *a*, when by the expansion of the spring S it will be thrown into the recess. This operation will occur in moving the handle H in any direction so as to carry the plates J and I past one pair of contact-plates on the spiders, and will thus cause the contact-arm G to be engaged and held in position, and after this impulses are sent into the apparatus to work it. The object of this is to prevent the operator from establishing a contact in the manipulating device without actually causing the plates to pass completely over one another. In the absence of such a device as I have here described he might move the handle H to establish a contact and then return it immediately to its original position without causing the plates to sweep past that contact. In such case it is obvious that on the return stroke the operator will not have established a reverse contact to bring the parts back to their normal position, since in order to do this it is necessary for him to cause the moving plates to pass completely over one contact and then back again over the same contact.

I have stated that in the manipulating device shown in Figs. 3, 4, and 5 the plates E F *e f*, &c., are spring contact-plates. The object of this is to enable them to yield as the plates J and I pass over or under them, as the case may be, and also to insure a quick break as the plates part company. Instead of making these stationary contact-plates E F *e f* spring-plates I may make them fixed plates and make the plates I J on the arm G spring-plates, one arrangement being the equivalent of the other.

Referring now to the safety-fuse represented at 58, I here exhibit a novel construction of such a device, which I will now explain. *c* is a pivoted lever, which is normally connected by the band *d*, which is the fuse proper and made of any suitable material to become melted when the strength of the current becomes too great, to the block *g*, which block is connected by wire *h* in circuit with the electromagnet 59 and the armature of the motor. *i* is a retracting-spring, which is prevented from drawing back the lever *c* by the presence of the fuse *d*. *j* is a block which is connected by another fuse *k* to the block *l*. This block by wire *m* is also connected to the electromagnet 59 and the armature of the motor.

The operation of the device is as follows: When the current reaches a previously-determined strength sufficient to melt the fuse *d*, the lever *c* is drawn by its retracting-spring *i* into contact with the block *j*, and circuit is established anew through the fuse *k*, or, in other words, the purpose of the device is in any case when a fuse breaks to substitute immediately and automatically another fuse in the circuit. This device is especially applicable to cases in which my invention is used for helm or rudder control, where the power required to move the rudder may be very greatly and suddenly increased by the momentary action of a heavy wave and almost as rapidly disappear. In such cases it is very desirable to substitute at once another fuse in the circuit, so as to prevent the cessation of the operation of the entire apparatus until the attendant can have time to put in a new fuse.

The purpose and function of the electromagnet 59 are to control an automatic friction-

brake, which is constructed as follows: m' is a pivoted brake-lever provided with a spring n, which normally tends to bring it into contact with the brake-disk o, which is on the armature-shaft. As long, however, as the magnet 59 is energized by the passage of the working current the lever m' is retracted against the pull of the magnet and hence away from the brake-disk o. When, however, the armature-circuit is interrupted in order to stop the motor, the spring n then retracts the brake-lever m' and carries its end in contact with the brake-wheel, and so by friction stops the momentum of the armature.

I do not claim herein the construction of the controlling device represented in Figs. 3, 4, and 5, for the reason that said manipulating device forms the subject of a separate application for Letters Patent, Serial No. 635,512, filed by me May 7, 1897, and is therein claimed.

I claim—

1. The method of controlling an electric motor, which consists in establishing in an electromagnetic circuit-closing device a succession of current impulses corresponding in direction to the deviation of the controlling-lever and thereby causing the armature of said motor controlled by said device to move in a direction corresponding to the direction of said current impulses and to an extent depending upon the number of current impulses, substantially as described.

2. The method of controlling an electric motor, which consists in transmitting to an electric magnetic controlling device the unweakened current on the mains as successive impulses, and thereby causing said controlling device to actuate mechanism to establish circuit from said mains through the motor-armature for a period corresponding to the aggregate number of said impulses, substantially as described.

3. The combination of an electric motor, supply-mains therefor, an electromagnet in circuit with said mains, means for producing successive closings of circuit through said magnet and mechanism actuated by said magnet for establishing circuit in said motor-armature, and causing a definite extent of motion thereof for each closing of circuit through said magnet, substantially as described.

4. The combination of an electric motor, supply-mains therefor, two electromagnets in circuit with said mains, a movable lever, means controlled by said lever for producing successive closings of circuit through one magnet or the other as said lever is deviated to a greater degree in one or the other direction, and mechanism actuated by said magnets respectively for establishing current in said motor-armature in direction corresponding to the deviation of the lever and for uniform periods corresponding to the number of successive closings of circuit, substantially as described.

5. The method of electrically controlling or adjusting from a distance a ship's rudder, turret, gun, signal apparatus or other adjustable mechanism by introducing into the circuit of the controlling device of an electric motor actuating said mechanism a succession of current impulses of substantially uniform strength and corresponding in direction to the deviation of the controlling-handle and in number to the extent of said deviation, substantially as described.

6. The combination with an electric motor, supply-mains and a controlling device having a movable lever such as H, an electromagnet 16, two contact-pieces as 26 and 30, a circuit-breaker constructed to break the armature-circuit of said motor when said pieces 26 and 30 are in contact, contact-piece 24, mechanism actuated by said electromagnet for breaking contact between pieces 30 and 26 and establishing contact between pieces 30 and 24, and mechanism actuated by the motor-armature for breaking contact between pieces 30 and 24 and establishing contact between pieces 30 and 26; whereby when said lever H is moved in definite direction circuit is broken through contacts 30 and 26 and closed through contacts 30 and 24, and circuit established through said last-named contacts to the motor-armature, and thereafter through the rotation of said armature-circuit is automatically broken between contacts 30 and 24 and closed through contacts 30 and 26, substantially as described.

7. The combination with an electric motor, supply-mains and a controlling device having a movable lever such as H, of electromagnets 15 and 16, two contact-pieces as 26 and 30, a circuit-breaker constructed to break the armature-circuit of said motor when said pieces 26 and 30 are in contact, contact-bar 24, mechanism actuated by electromagnets 15 and 16 respectively for moving said bar in opposite directions, thereby breaking contact between pieces 30 and 26 and establishing contact between pieces 30 and 24, and mechanism actuated by the motor-armature for moving piece 30 out of contact with bar 24 and into contact with piece 26; whereby when said lever is moved in one direction one magnet as 15 actuates said bar to break contact between pieces 30 and 26 and establish contact between piece 30 and said bar, and when said lever is moved in the other direction, the other magnet as 16 actuates said bar to move in the opposite direction, so that circuit is established through said contacts 30 and 26 and the motor-armature and thereafter through the rotation of said armature said piece 30 is returned into contact with piece 26, substantially as described.

8. The combination with an electric motor supply-mains and a controlling device having a movable lever such as H, of electromagnets 15 and 16, bar 24 of conducting material, mechanism between said bar and said

magnets whereby said magnets operate respectively to move said bar longitudinally in opposite directions, insulated contact 26 on said bar, a reversing-switch actuated by said magnets, magnets 13 and 14 acting upon said switch to place same in position to break circuit, mechanism actuated by the armature of said motor for causing said contact 30 to travel along bar 24, and circuit connections, substantially as described.

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(No Model.)

3 Sheets—Sheet 1.

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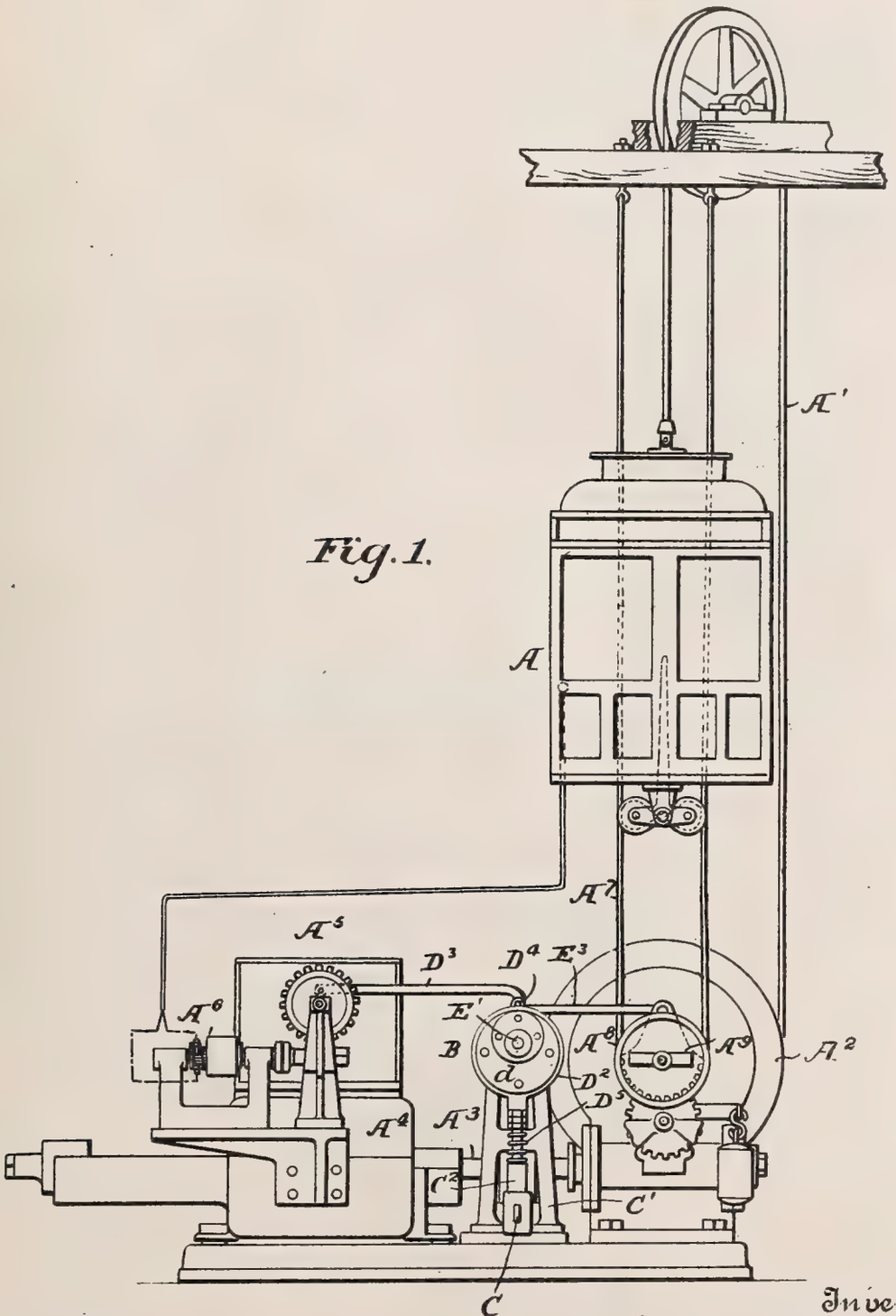
COMPOUND BRAKE FOR ELECTRIC ELEVATORS.

No. 596,513. Patented Jan. 4, 1898.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

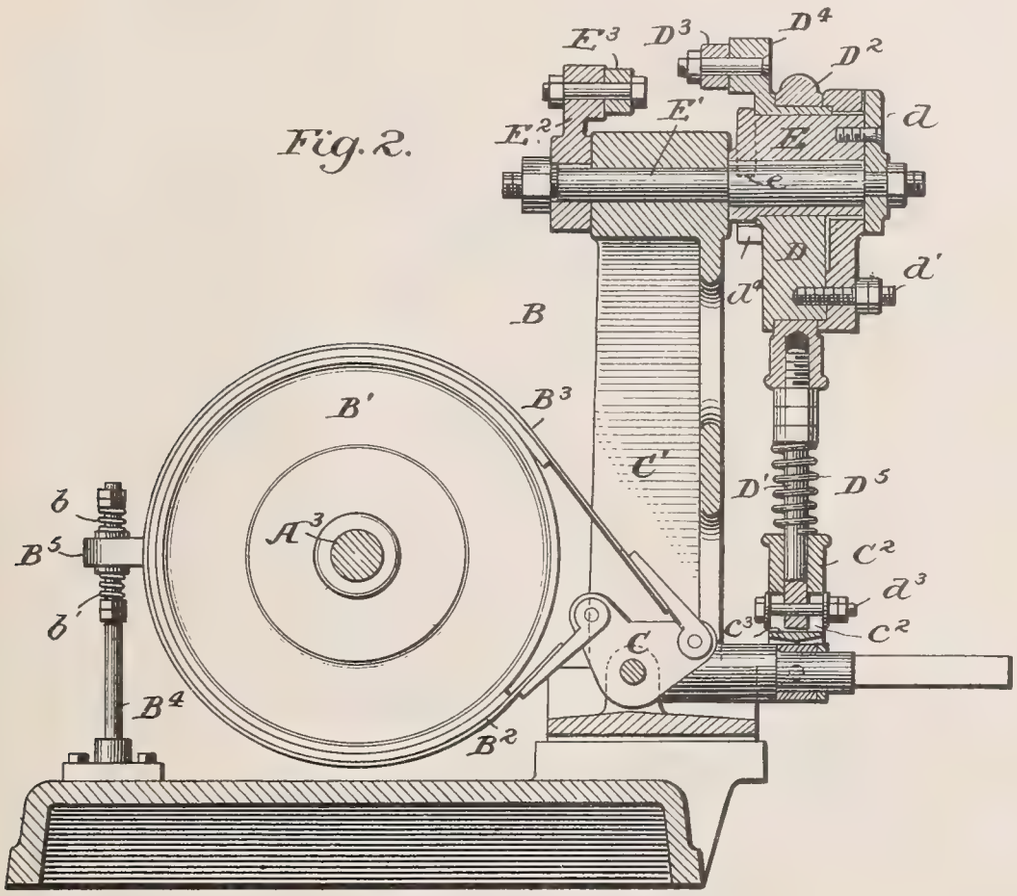
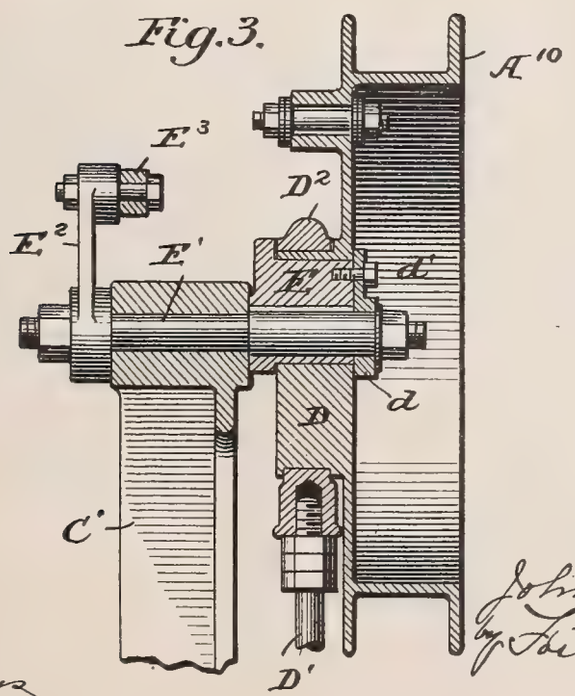


Fig. 3.



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No. 596,513. Patented Jan. 4, 1898.

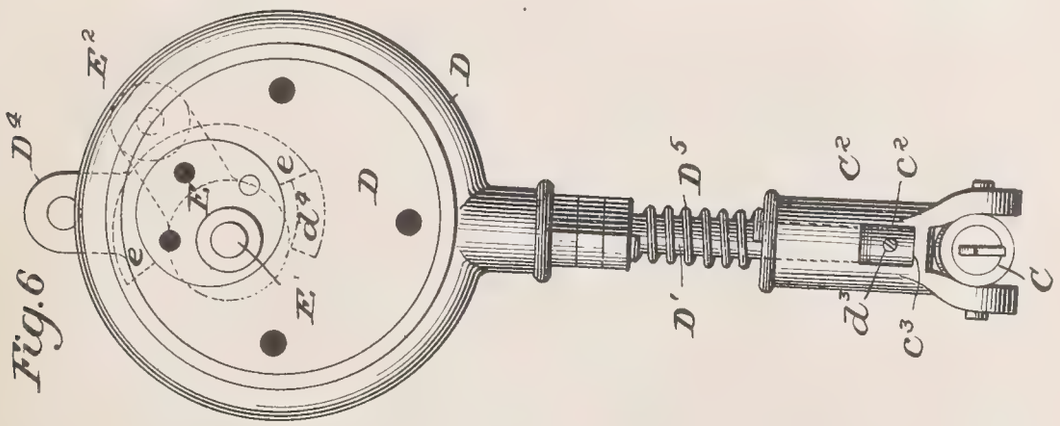

Fig. 6

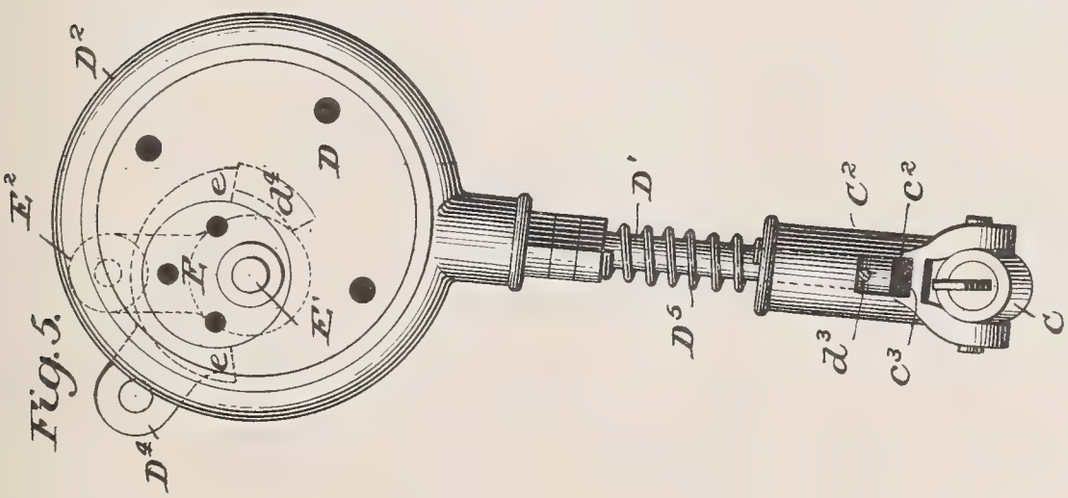

Fig. 5.

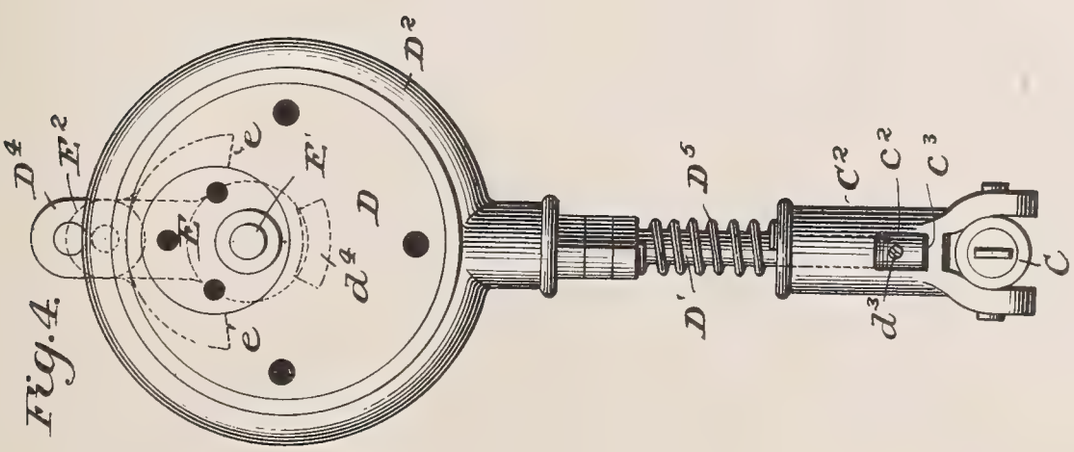

Fig. 4.

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UNITED STATES PATENT OFFICE.

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COMPOUND BRAKE FOR ELECTRIC ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 596,513, dated January 4, 1898.

Application filed September 14, 1896. Serial No. 605,783. (No model.)

To all whom it may concern:

Be it known that I, JOHN D. IHLDER, a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Compound Brakes for Electric Elevators, of which the following is a specification.

My invention relates to compound brake devices for electric elevators, and while it is intended to be used with and is shown as adapted to an electric elevator it will readily be understood that it can be used in connection with other elevators and other apparatus by those skilled in the art without departing from the spirit of my invention.

The object of my invention is to provide a brake apparatus for elevators and the like so constructed and arranged that when used in the ordinary operations at intermediate landings or otherwise it will apply a certain amount of pressure to the brake, which is preferably elastic or yielding, but sufficient to control the motions of the elevator, while under other conditions, as in case of emergency or when the cage arrives at the limit of its movement, a greater, more forcible, and direct action is imparted to the brake, which will insure absolute stopping of the apparatus; and with this general purpose and object in view my invention consists in a brake apparatus constructed and arranged to accomplish these purposes and operating in a manner substantially as hereinafter pointed out.

Referring to the accompanying drawings, Figure 1 is an elevation showing the general arrangement of an electric elevator apparatus and indicating the general relation of the brake device and means for operating it. Fig. 2 is an enlarged transverse section of sufficient of a brake apparatus to illustrate my improvement. Fig. 3 is a similar view showing another arrangement of the shifting devices in connection with the brake apparatus. Figs. 4, 5, and 6 are detached views showing the movements of the eccentrics in various positions.

As above stated, while my invention may be applied to many and various forms of devices where a brake is needed, it is especially applicable to elevators, and I have shown it in connection with electric elevators, and in Fig. 1 I have shown a general arrangement of such elevators wherein the cage A is connected to the hoisting-rope A', passing around the drum A^2, which is driven in this instance by a shaft A^3, operated by an electric motor A^4, controlled by a switch device A^5, which may be operated by a pilot-motor A^6, controlled by the electric circuit on the car or by the ordinary hand-ropes A^7, connected to a sheave A^8, or in any other suitable manner. Connected to the drum A^2 is an ordinary automatic stop device A^9, the construction of which need not be specifically described, though I prefer the construction described in my Letters Patent No. 558,075, and which operates automatically to stop the motor as the car reaches the extremes of its limit at the top or bottom of the well, and in the present instance I also connect the brake device with this automatic stop device when I use the direct positively-actuated brake in addition to the compression-brake, as hereinafter set forth. The brake device B in this instance is located between the drum and motor, and it is understood that in this construction when the motor is stationary the brake is applied and must be released before the motor can start. This is usually done by connecting the brake device with the starting device of the motor, and in the present instance it is connected with the switch device A^5, or vice versa. The switch device is connected with the brake device when the same is operated by the hand-rope A^7, as indicated in Fig. 3.

Referring more particularly to Fig. 2, B' is a brake-wheel on the shaft A^3, and there is some suitable braking device connected with the wheel, shown in the present instance as consisting of two brake-bands B^2 B^3, supported in the presence instance on a standard B^4, having springs b b' on opposite sides of a lug B^5, to which the bands are connected. The free ends of the bands are connected to a lever C, arranged on the frame of the machine and arranged so that as the lever is moved the bands are tightened or released around the brake-wheel B'. This lever is mounted at the base of the standard C', which

supports the operating mechanism of the brake. On this brake-lever is mounted a socket C^2, in which moves a rod D', connected to a strap D^2, mounted upon an eccentric D. This eccentric is supported on a shaft E' in the standard C', and is connected by a rod D^3, attached to a projection D^4, with the switch mechanism A^5, so that the eccentric D moves with the switch mechanism. The strap D^2 is held in position on the eccentric D by any suitable means, as the face-plate d and screws d', and interposed between the strap D^2 and the socket C^2 is a spring D^5. The end of the rod D' is provided with a pin d^3, moving in slot c^2 in the socket C^2.

With the construction so far described it will be seen that the brake device operates as a spring-compression brake device, and that in the normal position shown in Fig. 2 the brake is applied under pressure, the spring D^5 being compressed more or less, forming an elastic and at the same time substantial grip on the brake-wheel. When the starting mechanism is operated by any suitable means, the eccentric D is also moved, raising the strap D^2, releasing the pressure on the spring D^5, and as the rod D' moves upward the pin d^3, acting upon the upper wall of the slot c^2, lifts the socket and lever, releasing the brake; but when the stopping device is operated the eccentric is turned through the medium of the rod D^3 to its normal position, forcing the strap D^2 down, applying the lever, and then putting the lever under the tension of the spring D^5. In some cases I have found it satisfactory to use simply this construction as a spring-compression brake, especially in relatively small or slow-running elevators; but in larger or faster-running elevators it is desirable to have a direct positively acting brake.

By the use of the words "spring-compression brake" I mean a brake and connecting mechanism whereby the brake is held under the tension of a spring, and by the use of the words "direct positively acting brake" I mean a brake and connecting actuating mechanism whereby the brake acts directly and positively and does not depend upon the compression of a spring. In the apparatus shown the brake can be used first as a spring-compression brake, in which the brake is under the tension of a spring, and the same brake can be further operated to act directly and positively and is not dependent upon the resiliency of the spring. Further, this spring-compression brake thus far described is usually sufficient to control the movements of the elevator at the intermediate landings; but at the top and bottom of the shaft it is desirable to have a more direct positively acting brake, and I will now describe the manner of applying such brake to this compression-brake illustrated herein.

The shaft E' is provided with an eccentric E, which is rigidly mounted on the shaft and forms a bearing for the eccentric D. Connected to a projection E^2 on the shaft E' is a rod E^3, which is connected to the automatic stop device A^9. This eccentric E operates in connection with the eccentric D to apply the brake more forcibly when it is moved by the automatic stop device, and the eccentric E is provided with lugs e, arranged to engage with a lug or projection d^4 on the eccentric D.

In the arrangement shown in Fig. 3 the construction is substantially the same, except that there is a sheave A^{10} mounted on the shaft E', and in this way the eccentric D is operated directly by said sheave, and the switch is operated therefrom instead of the eccentric being operated from the switch.

Such being the preferred construction and arrangement of parts, (although, of course, other equivalent constructions can be used,) I will now proceed to describe the mode of operation, referring more particularly to Figs. 4, 5, and 6, which show face views of the eccentrics.

Assuming the elevator to be stationary, the parts are in the relative position shown in Fig. 4, with the brake applied, the spring D^5 being compressed and the parts acting as a compression-brake. When the motor is started, the rod D^3 is moved to the right or left to cause the elevator to go up or down, and the eccentric D is rotated on its bearing, which in this instance is the eccentric E, and the parts assume the position shown in Fig. 5, wherein the rod D' is raised, releasing the pressure on the spring D^5, and the pin d^3 has engaged the upper portion of the slot c^2, raising the lever C, releasing the brake-bands, and the elevator travels to the desired destination, when the operator moves the rod D^3 to its normal position, which of course restores the eccentric D to the position shown in Fig. 4, applying the brake as before.

Under ordinary operations of the elevator this brake is sufficient; but if the elevator is moving rapidly it may be necessary or desirable to apply greater braking power to properly stop the elevator, and I provide what may be called an "emergency-brake," by means of which the operator can apply a direct positive-acting brake to the engine. Again, it is generally desirable to apply greater braking power to the motor as the car reaches the extremes of its limit at the top or bottom of the well, and this I provide for by means of the direct positive-acting brake being arranged and connected to be operated automatically, as by the automatic stop device of the engine. Furthermore, if perchance the operator should fail to apply the brake as the car reaches the limits of its movement it is desirable that the brake should be automatically and positively applied, and this is provided for by arranging the parts so that the automatic stop device will apply the brake and apply it more forcibly than in an ordinary stop. Thus, as shown, the automatic stop device A^9 is arranged to move the rod E^3 to its normal position (shown in Fig. 1) when the car reaches the extremes of its move-

ment at top or bottom, and, furthermore, in order to provide the emergency-brake the rod E^3 is connected to be operated by the sheave A^9, which is shown as being operated by the hand-rope A^7 from the car. With this construction it will be seen that when the rod E^3 is operated it turns the eccentric E on the shaft E', as seen in Fig. 6. If the operator has previously applied the spring-compression brake, the effect of the movement of the eccentric E is to force the eccentric D down farther, applying more pressure to the brake. If, however, the operator has failed to set the compression-brake, moving the rod E^3 will operate the eccentric E, and this, by means of the lugs *e* coming in contact with the lug d^1, will turn the eccentric D to its normal position and the parts will assume the relations shown in Fig. 6, in which it will be seen that the spring D^5 is more compressed, thereby applying greater pressure to the brake-lever, and, further, I prefer to arrange the rod D' so that under these conditions it will bear positively upon the base c^3 of the socket C^2, forming a positive bearing thereon, and consequently more positive action of the brake, which will insure the immediate stopping of the car.

It will be seen that the eccentric E and its connecting-rod E^3 can be operated from the car by the hand-ropes A^7 when connected to sheave A^8, so that in case of emergency the operator can apply both the spring-compression and direct positively-acting brakes and bring the car to a state of rest. Sometimes, however, it is not deemed necessary to provide the intermediate emergency-brake, and in that case the hand-rope A^7 is connected to the sheave A^{10} in Fig. 3 and the pilot-motor A^6 is dispensed with; or either the hand-rope A^7, connected to the sheave A^{10}, or the pilot-motor A^6 may be used, and the emergency or direct positively-acting brake be applied only by the automatic stop devices as the car reaches the top or bottom of its travel.

If it is desired to start the elevator in the reverse direction after the emergency or direct positively-acting brake has been applied, turning the eccentric D by the hand-rope or otherwise will release the brake, and in order to insure this action I preferably arrange the relations of the eccentrics so that the eccentric D will move the brake-lever considerably more than the eccentric E when acting alone.

From the above description the general principles of my invention will be understood by those skilled in the art, and it will be seen that these may be applied and used with various constructions or details of mechanism, so that my invention is not limited to the construction shown and described, but includes equivalent forms of mechanism, and it will further be seen that my invention can be used in whole or in part or in combination with other equivalent constructions.

What I claim is—

1. The combination with the brake of an elevator-engine, of a spring-compression device connected with the brake, a direct positively-acting device also connected with the brake, and means for operating both devices to apply the brake in the manner and for the purpose described.

2. The combination with the brake of an elevator-engine, of a spring-compression device connected with the brake, a direct positively-acting device also connected with the brake, means for operating the spring-compression device independent of the direct positively-acting device, and means for operating the direct positively-acting device whereby the spring-compression device may be operated to apply the brake, or both the spring-compression device and direct positively-acting device may be operated to apply the brake, substantially as described.

3. The combination with the brake device of an elevator-engine, of an eccentric, connections with the eccentric whereby it can be controlled by the operator, a strap mounted on the eccentric, a rod connected to the strap, a socket mounted on the brake device, and a spring interposed between the strap and socket, substantially as described.

4. The combination with the brake device of an elevator-engine, of an eccentric, connections with the eccentric whereby it can be controlled by the operator, a strap mounted on the eccentric, a socket provided with a slot connected to the brake device, a rod connected to the strap and entering the socket, a pin in the rod, and a spring interposed between the socket and strap, substantially as described.

5. The combination with the automatic stop-motion device and the brake device of an elevator-engine, of two eccentrics, connection between the eccentrics and brake device, connections with one of the eccentrics whereby it can be controlled by the operator, and connections with the other eccentric whereby it is controlled by the automatic stop-motion device, substantially as described.

6. The combination with the automatic stop-motion device and the brake device of an elevator-engine, of means under the control of the operator for applying the brake, and means connected with the automatic stop device for applying additional power to the brake, substantially as described.

7. The combination with the brake device of an elevator-engine, of a shaft, two eccentrics supported by said shaft, means for operating the eccentrics independently, and connections between the eccentrics and the brake device, substantially as described.

8. The combination with the automatic stop-motion device and the brake device of an elevator-engine, of a shaft, an eccentric rigidly mounted thereon, connections between the shaft and the automatic stop device of the elevator-engine, a second eccentric mounted on the first eccentric, connections between the second eccentric and the starting and stop-

ping mechanism of the engine, and connections between the eccentrics and brake device, substantially as described

9. The combination with the brake device of an elevator-engine, of a shaft, an eccentric mounted thereon, connections between the shaft and the automatic stop device of the elevator-engine, a second eccentric mounted on the first eccentric, connections between the second eccentric and the starting and stopping mechanism of the engine, a strap mounted on said eccentric, elastic connections between the strap and the brake, and means whereby when both eccentrics are operated a positive movement is applied to the brake, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN D. IHLDER.

Witnesses:
WM. P. CONSTABLE,
H. BEATTIE BROWN.

(No Model.)

F. S. BRAID.

ELEVATOR CONTROLLER.

No. 605,471. Patented June 14, 1898.

Fig. 1.

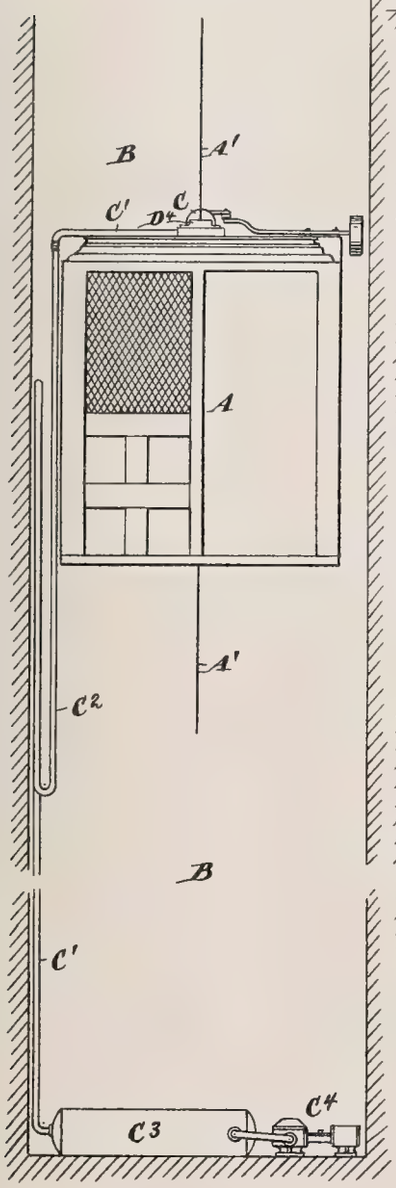


Fig. 2.

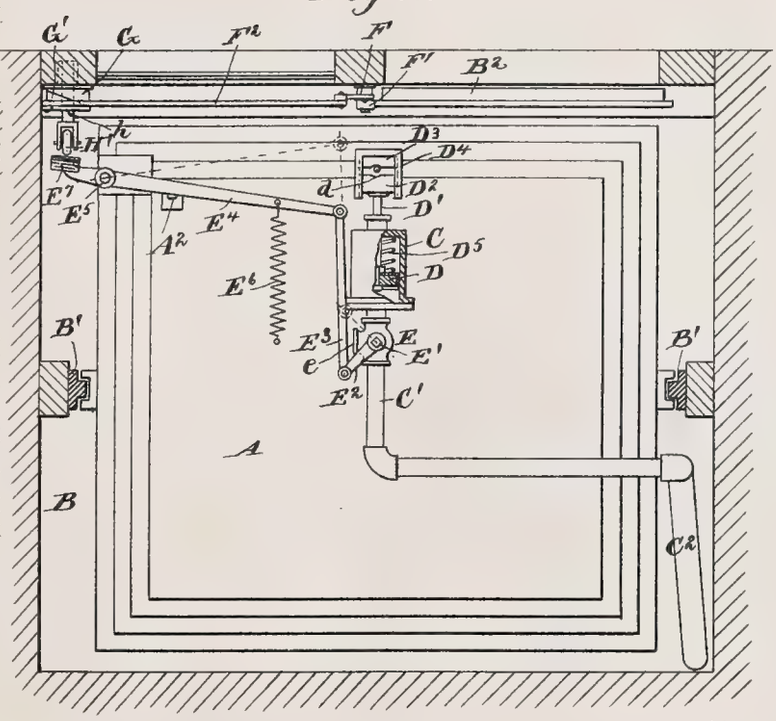


Fig. 3.

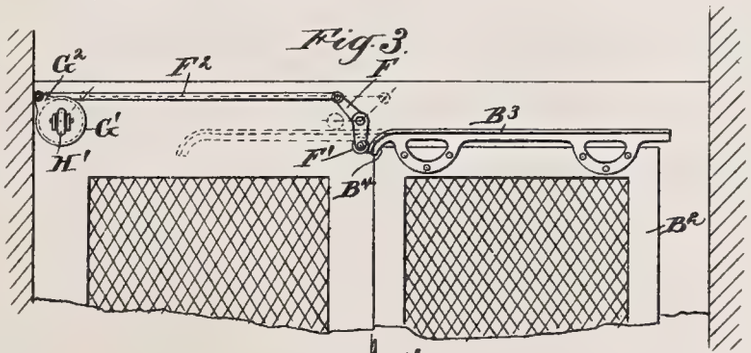


Fig. 4.

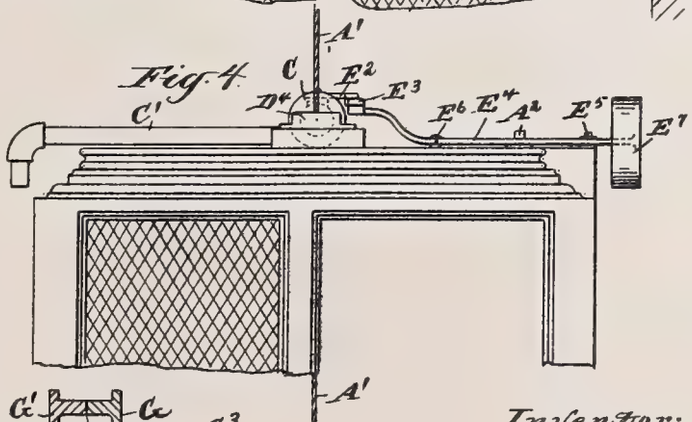
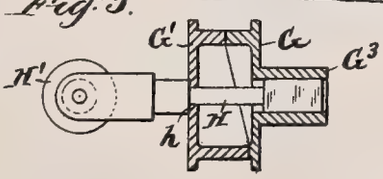


Fig. 6.

Fig. 5.



Witnesses:
P. C. Collins
M. E. Grace

Inventor:
Fountain S. Braid,
by his attorney
Charles R. Seaule.

THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FOUNTAIN S. BRAID, OF NEW YORK, N. Y.

ELEVATOR-CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 605,471, dated June 14, 1898.

Application filed January 25, 1898. Serial No. 667,847. (No model.)

To all whom it may concern:

Be it known that I, FOUNTAIN S. BRAID, a citizen of the United States, residing in New York, (Brooklyn,) in the State of New York, have invented a certain new and useful Improvement in Elevator-Controllers, of which the following is a specification.

The invention relates to that class of improvements in elevators in which the act of opening the shaft-door clamps the hand-rope through a train of mechanism and prevents operating the hoisting mechanism until the door is again closed and the hand-rope released.

The object of this invention is to simplify the mechanism, while affording a reliable, positive, and uniform grip on the rope, independent of the force exerted in opening the door.

It consists, essentially, of a clamp carried on the car and inclosing the rope between its jaws, actuated by the movement of a piston in a cylinder also carried on the car and receiving pressure from a reservoir which may be at a distant point connected to the cylinder through a flexible tube or hose, and means for admitting the pressure to the cylinder by the act of opening the shaft-door. I prefer to use compressed air admitted to and exhausted from the cylinder through a suitable valve, requiring but little force to operate it and consequently offering but little resistance to the motion of the shaft-door, while the force exerted upon the rope by the clamp is entirely independent of such movement and is wholly determined by the pressure received in the cylinder. The force is practically uniform and may be regulated by increasing or diminishing the normal pressure in the reservoir.

The accompanying drawings form a part of this specification and show the manner in which I have carried out the invention.

Figure 1 is a front elevation of a car equipped in accordance with my invention. Certain portions are omitted for clearness. The elevator-shaft is shown in vertical section. The remaining figures are on a larger scale. Fig. 2 is a plan or top view of the car and a horizontal section through the shaft. Fig. 3 is a corresponding vertical section of a portion of the shaft, showing the top of the door and its connections in elevation. Fig. 4 is a front elevation of the upper portion of the car and its mechanism. Figs. 5 and 6 are sectional views showing certain details of construction.

Similar letters of reference indicate the same parts in all the figures.

A is a passenger-elevator of any ordinary or approved construction, guided vertically in the shaft B by the ways B′ and raised and lowered by any suitable hoisting ropes and mechanism (not shown) controlled by the hand-rope A′, passing through the car, as usual.

B^2 is the shaft-door, sliding horizontally at the landing in ways. (Not shown.) The arrangement at each landing is similar and a description of one will suffice.

On the top of the car is mounted the cylinder C, receiving compressed air behind the piston D through a pipe C′, a portion of which is a flexible tube C^2, from a reservoir C^3, located at any convenient place, preferably at the bottom of the shaft adjacent to the hoisting mechanism, and supplied by an air-pump C^4, of any approved type, operated either directly or from a moving part of the hoisting mechanism. From the front of the piston D extends a rod D′, suitably guided and carrying at its end a block D^2, having a vertical semicylindrical groove *d* and forming with the fixed block D^3, having a similar groove, a pair of clamping-jaws partly inclosing the hand-rope A′. The movable jaw D^2 slides in the ways D^4, carrying the fixed jaw D^3 and firmly secured to the top of the car. A spring D^5 within the cylinder exerts its force in the direction to move the piston backward and hold the jaws normally open.

E is a three-way cock placed in the pipe C′ at any convenient point adjacent to the cylinder. The plug E′ is turned by the arm E^2 from the horizontally-vibrating lever E^4 through the link E^3. The ports are so arranged (see Fig. 6) that a quarter-turn of the plug admits air-pressure behind the piston and the reverse movement shuts off the supply and allows the compressed air in the cylinder to escape through the opening *e*. The lever E^4 turns on a fixed center E^5 and is subject to the force of a spring E^6, tending to move it in the direction to exhaust the

cylinder, such motion being limited by the fixed stop A^2. On the overhung end of the lever is a vertical face-plate E^7, by which the lever is moved in opposition to its spring through means to be now described.

On the upper portion of the framing carrying the door B^2 and within the shaft is mounted a lever F, the lower arm carrying a roller F′ and the upper arm joined to one end of a link F^2, connected at the other to a projecting lug G^2 on a cam device serving to change the motion angularly, so that it acts against the plate E^7, above described. This device consists of a cylindrical casing divided on a spiral line, one portion, G, fixed to the framing and the other, G′, carrying the lug G^2, rotatable relatively thereto by the motion of the link F^2. Through the axis extends a rod H, the outer end of which carries a roller H′, lying in the path of the plate E^7, and the other squared to match to a similarly-shaped extension G^3 of the fixed portion G, in which it may slide, but is held against rotation. The movable portion G′ rests against the shoulder *h* on the rod and when partially rotated travels up the spiral, thus forcing the rod and its roller H′ outwardly, or, rather, inwardly relatively to the shaft. This rotative motion is transmitted from the lever F and is received by the latter from the movement of the door B^2 in the direction to open it. The door carries along its top edge a track or way B^3, curved downwardly at B^4 adjacent to the roller F′ and lying in such relation thereto that as the door is moved in the direction to open it the curve B^4 strikes the roller and begins to turn the lever F, the turning continuing until the roller lies upon the horizontal portion B^3 of the track and travels idly thereon as the door is moved farther without causing further movement of the lever. When the car is stopped with its floor approximately level with the landing, the plate E^7 lies adjacent to and in the line of motion of the rod H, and as the latter is thrust outward from its casing by the act of opening the door its roller strikes the plate and turns the lever E^4, which through the link E^3 and arm E^2 communicates the motion to the plug E′, as above described, and admits pressure behind the piston and closes the clamp. The parts are so proportioned that a full quarter-turn is given to the plug and the full pressure is immediately felt by the jaws D^2 D^3 and hand-rope A′. While thus held, the rope cannot be moved relatively to the car, and consequently the latter cannot be started in either direction. On closing the door the parts assume their normal positions, reversing the plug E′ and allowing the air behind the piston D to escape. The piston is immediately forced backward by the spring D^5, carrying with it the jaw D^2, and thus the rope is again liberated, allowing the operator through its medium to start the hoisting mechanism.

The plate E^7 is given considerable vertical length, so that the roller H′ will be sure to find it even though the car-floor and landing be not exactly in the same plane. The upper and lower portions of the plate are curved backward, as shown, and serve to strike the roller and actuate the clamp if by accident or design one of the shaft-doors should be opened from its landing and not closed before the passage of the car.

The flexible portion C^2 of the pipe C′ allows the free travel of the car without interrupting the communication with the reservoir C^3. The latter may be equipped with a safety-valve loaded to a predetermined pressure, which will lift when that pressure is exceeded and thus tend to maintain a constant pressure while the pump is running.

Modifications may be made without departing from the principle of the invention or sacrificing its advantages.

The train of mechanism from the door to the cylinder may be varied within wide limits or other means substituted, and other means for controlling the admission and exhaust may be employed in place of the three-way cock shown.

Although I have described the invention as using air-pressure, it will be understood that other gases or fluids under pressure will serve successfully.

I claim—

In an elevator-controller of the character herein set forth, a clamp carried by the car and adapted to grasp and hold the operating-rope, a cylinder also carried by the car and receiving pressure, a piston mounted in said cylinder and moved by said pressure to actuate said clamp, and mechanism operated by the door in opening and closing, controlling the admission of pressure to said cylinder, so that the operating-rope will be clamped when said door is open and released when closed, all combined and arranged to serve substantially as and for the purposes herein specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

FOUNTAIN S. BRAID.

Witnesses:

ROBT. CONNOR,

P. E. CULLIN.

No. 657,597. Patented Sept. 11, 1900.

E. L. & G. HAIL.

ELEVATOR.

(Application filed Dec. 27, 1898.)

(No Model.) 3 Sheets—Sheet 1.

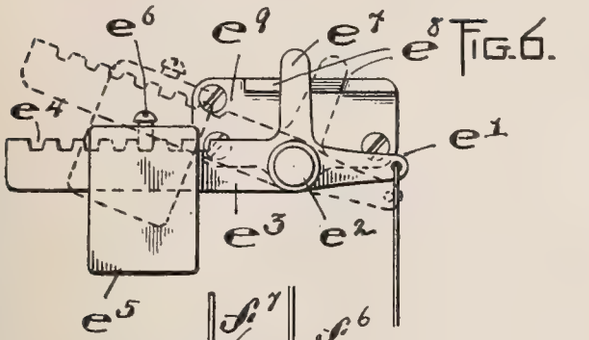


FIG. 6.

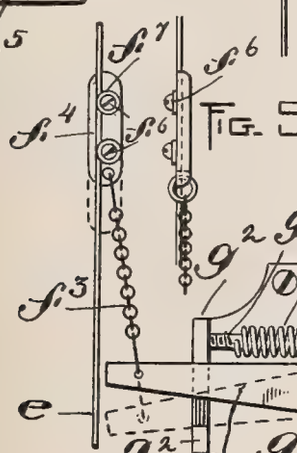


FIG. 5.

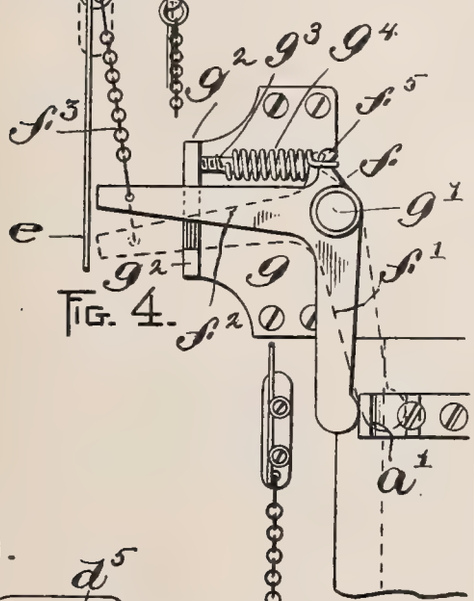


FIG. 4.

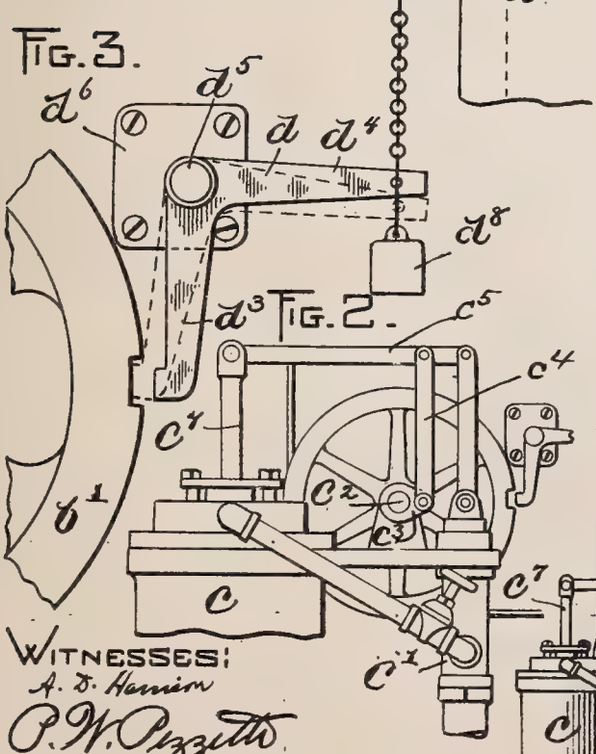


FIG. 3.

FIG. 2.

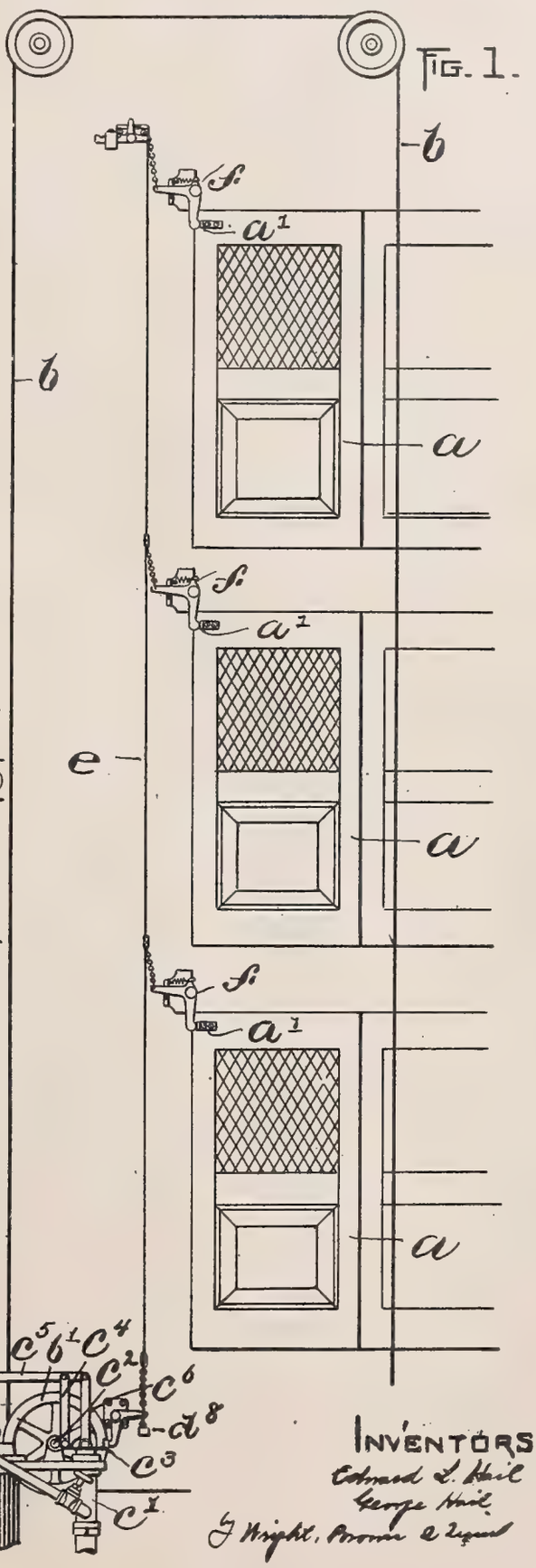


FIG. 1.

WITNESSES:
A. D. Harrison
P. W. Pezzetti

INVENTORS
Edward L. Hail
George Hail
by Wright, Brown & Quinby
Their Attys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

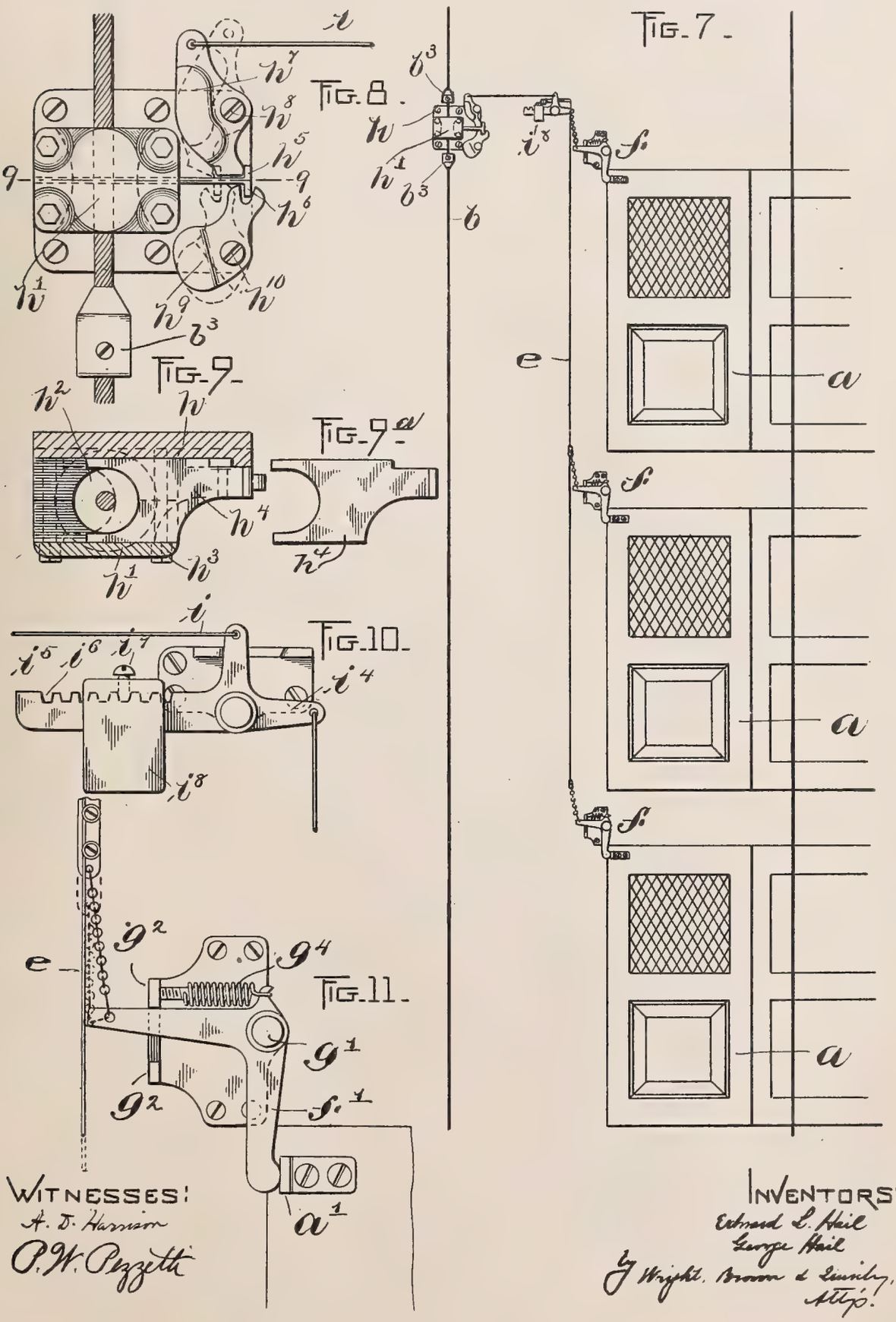
No. 657,597. Patented Sept. 11, 1900.

E. L. & G. HAIL.

ELEVATOR.

(Application filed Dec. 27, 1898.)

(No Model.) 3 Sheets—Sheet 2.



WITNESSES:
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INVENTORS:
Edward L. Hail
George Hail
by Wright, Brown & Quinby, Attys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 657,597. Patented Sept. 11, 1900.

E. L. & G. HAIL.

ELEVATOR.

(Application filed Dec. 27, 1898.)

(No Model.) 3 Sheets—Sheet 3.

FIG. 13.

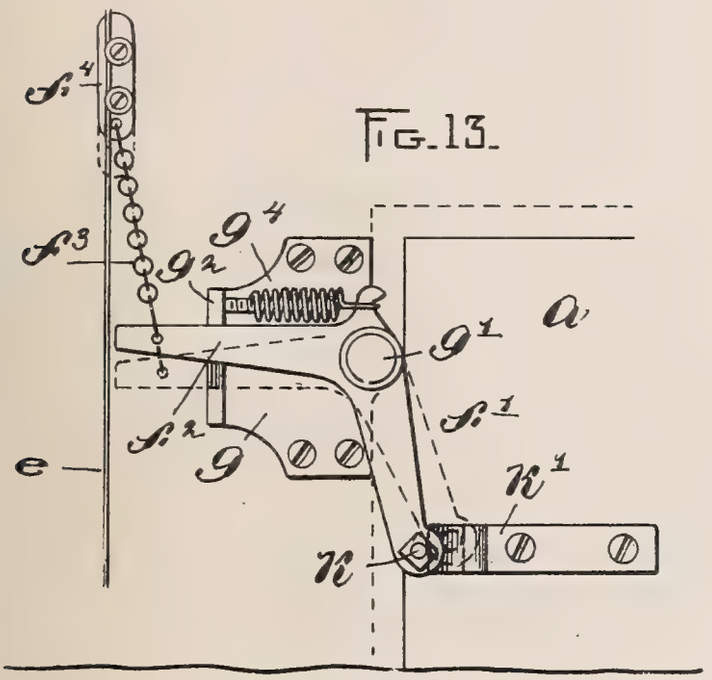


FIG. 14.

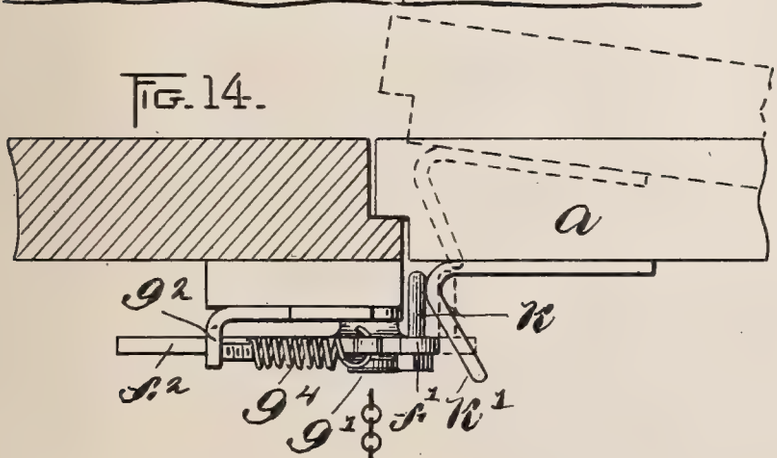


FIG. 15.

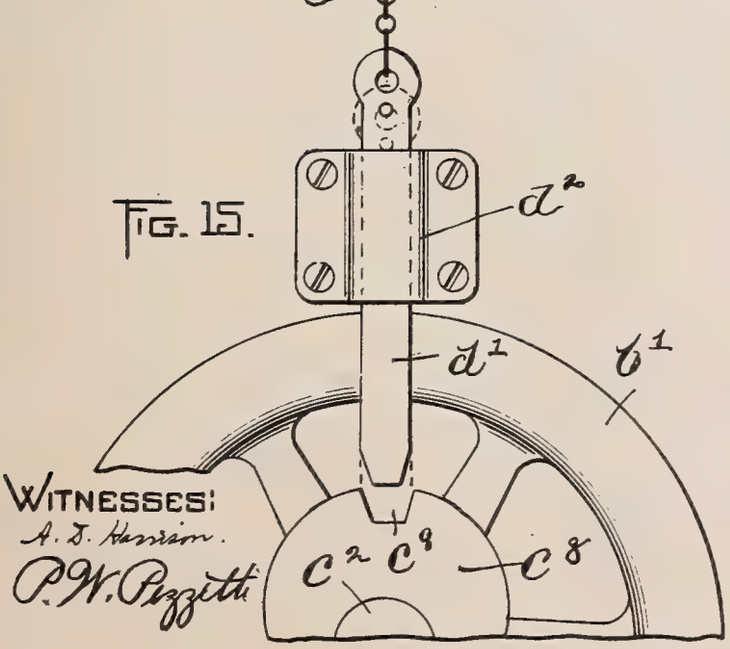
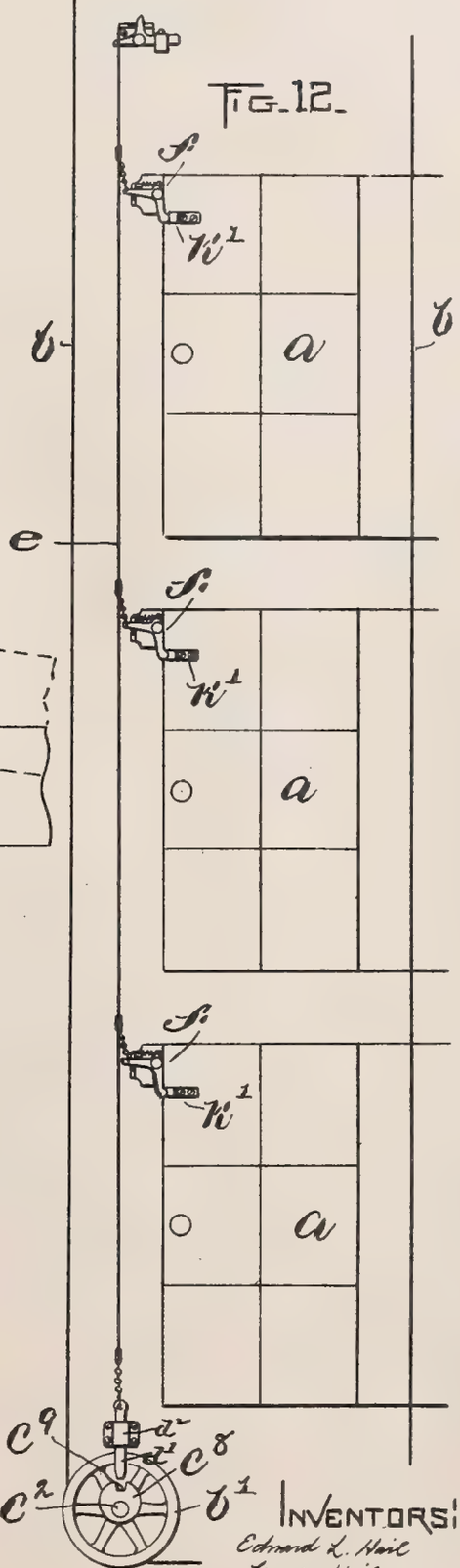


FIG. 12.



WITNESSES:
A. D. Harrison.
P. W. Pezzetti

INVENTORS:
Edmund L. Hail
George Hail
by Wright, Brown & Quinby.
Attys.

THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

EDWARD L. HAIL AND GEORGE HAIL, OF PROVIDENCE, RHODE ISLAND.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 657,597, dated September 11, 1900.

Application filed December 27, 1898. Serial No. 700,363. (No model.)

To all whom it may concern:

Be it known that we, EDWARD L. HAIL and GEORGE HAIL, of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Elevators, of which the following is a specification.

This invention has relation to elevator safety appliances of the class for preventing movement of the car when a door leading into an elevator-hatchway is partially or entirely open; and it has for its objects the provision of certain improvements in the same for the purpose of rendering the mechanism more simple and more easily installed than heretofore, enhancing the general efficiency of appliances of the character mentioned, and reducing their liability to get out of order.

To attain the various objects of the invention, it consists in a safety appliance or apparatus embodying certain features of construction and relative arrangement of parts, all as illustrated upon the drawings, hereinafter described in detail, and set forth in the appended claims.

Reference is to be had to the accompanying drawings, and to the letters marked thereon, forming apart of this specification, the same letters designating the same parts or features, as the case may be, wherever they occur.

Of the drawings, Figure 1 represents an elevator plant equipped with our invention. In this figure there is shown a series of corridor-doors leading into the elevator hatchway or well and a portion of the controlling device for a hoisting mechanism, the same consisting of a pilot-valve and a main valve and means controlled by the door for locking the pilot-valve when one of the doors is open. Fig. 2 represents an enlarged view of the valve and the pilot-valve. Fig. 3 shows in detail the door-controlled lock for a movable member of the pilot-valve. Fig. 4 represents a lock-controlling wire and one of the door-controlled levers which is connected to the wire by a clip and a chain. Fig. 5 shows in detail the clip to which one end of the chain is connected. Fig. 6 represents a balance-lever from one arm of which the line depends. Fig. 7 represents the invention as being arranged to lock the motor-controlling line. Figs. 8, 9, and 9^a represent in detail the lock for the controlling-line. Fig. 10 illustrates a counterbalancing-lever as provided with an arm to control the lock for the motor-controlling means. Fig. 11 illustrates the door-actuated lever shown in Fig. 4, with the line dropped a little to show the action of the flexible connection between the lever and the said line at such time. Fig. 12 represents another embodiment of the invention especially adapted for use in connection with swinging doors. Figs. 13 and 14 show the action of the door upon the door-actuated levers. Fig. 15 shows the lock in position to engage a locking member on the pilot-valve.

Referring to the drawings, the doors which lead into the hatchway at the landings are indicated at *a*, those shown in Figs. 1 and 7 being arranged to slide across the openings and those in Fig. 12 being adapted to swing, the doors of this latter class being usually fireproof doors in factories, warehouses, and other similar buildings. The elevator-car is not shown, but it travels up and down the hatchway past the doors in the ordinary way, being generally suspended from one or more cables, which pass over sheaves at the top of the hatchway and are attached to counterbalancing-weights which travel in guides.

The car, so far as some features of the invention are concerned, may be raised or lowered by a motor of any suitable kind—such as those operated by steam, hydraulics, or electricity—the motor-controlling means comprising any suitable mechanism, such as one or more lines *b*, and a movable member, such as a tip-lever or a wheel *b'*, arranged to govern the movements of the motor. In Fig. 1 the motor is shown as being controlled by a main valve *c*, which is regulated by a pilot-valve *c'*. The wheel *b'* is rigidly secured to a rock-shaft c^2, on which there is a crank c^3, connected by a rod c^4 with a transverse lever c^5. One end of the last-mentioned lever is connected by a rod c^6 with the piston of the pilot-valve; but its other end is connected with the piston-rod c^7 of the main valve. By rotating the wheel *b'* and rocking the shaft c^2 in one direction or the other fluid is admitted to either end of the main hydraulic cylinder or is cut off therefrom to raise or lower the car or bring it to a state of rest. The parts are so arranged, however, that when the car

is at rest the shaft or wheel b' is always in the same position. A notch is cut in the periphery of the shaft or wheel b', which thus constitutes what may be termed a "locking member" for the pilot-valve, and a lock is placed in such position as to enter said notch and prevent the wheel from rotating when one of the doors is open. Although, as shown in Fig. 1, the lock may directly engage the rope-wheel, yet, if desired, we may secure a supplemental locking member c^8 to the rock-shaft c^2, as shown in Figs. 12 and 15, in which event the locking member may be a segment or may be a small arm having a notch c^9 to receive the lock d', which in this case is a bolt movable in a guide d^2. In Figs. 1 and 3, however, the lock for the pilot-valve consists of a bell-crank lever d, having one arm d^3 arranged to enter the notch in the wheel b' and having its other arm d^4 apertured at its end to be connected to the end of a line e, which extends up the elevator shaft or hatchway, as will be subsequently described. The bell-crank d is fulcrumed on a pivot-stud d^5, projecting from a plate d^6, having provisions for permitting its attachment to a suitable support. A flexible chain connects the end of the bell-crank to the wire or line, being secured to the latter by a clip, which will be subsequently described. A weight d^8 is hung from the bell-crank, and its tendency is to draw the bent end of the arm d^3 into the notch in the locking member of the pilot-valve, this action being prevented so long as the doors a are closed by the line e, previously referred to. This line extends up the shaft or hatchway, and it consists of a wire whose upper end is connected to one arm e' of a lever fulcrumed on a pivot-stud e^2, extending out from a plate e^9 and having its other arm e^3 extended and provided with notches e^4 in its upper edge. An adjustable weight e^5 is supported upon the arm e^3 and is provided with a set-screw e^6 to enter any one of the notches e^4 and hold the weight immovable. The weight e^5 is sufficient to slightly more than counterbalance the weight of the wire e and the parts supported by it and the tension of the weight d^8. The lever has a third arm e^7, which plays between two lugs or stops e^8 on the plate e^9. Arranged in the path of each door a there is a bell-crank lever f, each having an arm f', projecting downwardly to be engaged by a stud, projection, or bracket a' on the door at the last of its closing movement and moved into the position shown in full lines in Fig. 4. These door-controlled levers each have an arm f^2, which is connected by a flexible connection f^3 with a clip f^4, adjustably and detachably secured to the wire e. A plate g is provided with a pivot-stud g', on which the lever f' is fulcrumed, said plate having two lugs or stops g^2 g^2, between which the arm f^2 lies and which limit the movements thereof, as shown in Fig. 4. In each of the lugs there is an aperture (not shown) to receive a detachable screw g^3, to which a spring g^4 is attached, said spring having its free end engaging a finger f^5 on the bell-crank lever. Each spring g^4 is strong enough to overbalance the weight e^5 and permit the weight d^8 to throw the lock into engagement with the locking member of the pilot-valve when the door is opened. This construction and arrangement of parts permits the lever to be reversed and the spring to be attached to either of the lugs. The flexible connection f^3 consists of a chain formed with a series of connected links, and it is attached to the clip f^4, which, as shown in Fig. 5, is formed with a groove to receive the wire e, said wire being held in the groove by screws f^6 and washers f^7. In this form of the invention just described the door-controlled levers, the line e, and the lock may be said to constitute means for directly engaging and locking a movable element or locking member of the pilot-valve or for locking the controlling rock-shaft c^2, by means of which the pilot-valve is governed, said door-controlled levers and the said line e constituting door-controlling devices for the lock. The operation of this device hardly requires explanation, for it will readily be seen that when the doors are all closed, as shown in Fig. 1, the weight e^5 is sufficient to draw the lock out of engagement with the locking member of the pilot-valve. When one of the doors is opened the lever f which is engaged therewith follows it under the tension of the spring g^4, and the arm f^2 draws upon the flexible connection f^3 to pull the line e downward against the tension exerted by the weight e^5 to permit the weight d^8 to cause the engagement of the lock with the locking member of the pilot-valve. As the line e moves downward the chains f^3 do not exert pressure upon the other door-controlled levers, but become loose and slack, as shown in Fig. 11.

In Figs. 7 to 10, inclusive, we have shown another embodiment of the invention, in which the motor-controlling means is locked by the opening of one of the doors. In this case the controlling-line b is provided with a pair of stops b^3 b^3, which are conical at one end, said conical ends pointing in opposite directions. At some point in the hatchway, preferably near the top, we secure a casing consisting of a plate h, having a cap h', there being between the plate and the cap an aperture h^2, adequate to permit the passage of the clips or stops b^3. The cap is held in place by a series of bolts or screws h^3. A groove is formed in the plate and cap to receive a locking-plate h^4, (shown in Fig. 9,) which is adapted to partially close the aperture h^2, and thereby prevent the passage of the movable stops b^3, and consequently prevent the operation of the motor-controlling means. This plate h^4 is formed with a semicircular aperture in its inner end and at its outer end is provided with transversely-extending lugs h^5 h^6. The weight h^7 is fulcrumed at h^8 on the plate h in such way as to engage the lug h^5 and normally hold the locking-plate in the

position shown in full lines in Fig. 9, and to throw the plate inward there is another weight h^9, fulcrumed at h^{10} below the locking-plate and engaging the lug h^6. The weight h^7 is heavier than that at h^9, so that it more than counterbalances the latter and holds the locking-plate outward. In this construction the opening of the door draws downward upon the line e, and the weight h^7 is drawn into the position shown in dotted lines in Fig. 8 to permit the other weight to operate and cause the locking-plate to be thrown into position to engage the stops on the motor-controlling line. In case one of the doors should be opened while the car is traveling and the locking-plate be thrown into the dotted-line position in Fig. 9 on stopping the car by shifting the valve-controlling means to a neutral position the conical end of the stop will force back the locking-plate and permit it to pass through, although the plate will immediately move back again into locking position, so as to prevent the other stop from passing through or the first-mentioned stop from returning.

It is evident that the invention may be employed in connection with swinging doors instead of those that slide horizontally, as shown in Fig. 13, the only change required being that a pin k is attached to each one of the door-controlling levers and a lug or bracket k' is secured to one of the doors to engage said pin, as shown in Fig. 14. It is also evident that various parts of this safety appliance may be employed separately, and consequently it will be understood that we are not limited to employing them all together. We may also employ electrical means between the door and lock for locking the controlling device, such means being now well known.

We have employed the term "door" as meaning an obstruction of any kind to prevent passage through a doorway and intend to include therein gates, bars, extensile and contractile gratings, and other similar forms.

Parts of this invention are applicable to elevator systems in which the hoisting mechanism consists of an electric motor, so that the lock engages a movable controlling member of the motor to cut off the current or to hold the said member in a neutral position.

Having thus explained the nature of the invention and described a way of constructing and using the same, though without attempting to set forth all of the forms in which it may be made or all of the modes of its use, we declare that what we claim is—

1. In an elevator, a plurality of doors, a motor-controlling line having stops, a lock for said line having a sliding locking-plate, a lever having one arm connected to said plate, a line connected to said lever, and a lever coacting with each door and flexibly connected with said last-mentioned line.

2. In an elevator, a plurality of doors, a motor-controlling line having stops, a lock for said line having a sliding locking member, a three-armed lever having one arm weighted, and a second arm connected with the said member, a line connected to the third arm of said lever, and a plurality of door-controlled levers flexibly connected with the last-mentioned line.

3. In an elevator, a plurality of laterally-sliding doors, a valve for governing the motive force, a plurality of door-controlled levers adapted to directly engage said doors, a wire extending from the top to the bottom of the elevator-well and connected to said levers, to move downward when any one of said levers is actuated by the opening of the door adjacent thereto, means independent of said levers for overbalancing said wire when the doors are closed, and a lock connected to the wire and adapted to lock a movable member of the valve.

4. In an elevator, a plurality of laterally-sliding doors, a valve for governing the motive force, a plurality of spring-tensioned elbow-levers engaging said doors, a wire extending from the top to the bottom of the elevator-well and connected to said levers, a lock connected to said wire to lock a movable member of the valve against movement when any one of the doors is opened, and a weighted lever for yieldingly supporting the said wire and permitting it to be pulled downward by any one of said levers.

5. In an elevator, a plurality of laterally-sliding doors, a valve for governing the motive force, a plurality of door-controlled levers adapted to directly engage said doors, a wire extending from the top to the bottom of the elevator-well and adapted to be pulled downward by any one of said levers, a lock for said valve connected to said wire, yielding means independent of the levers for supporting the said wire, and flexible connections between said levers and said wire.

6. In an elevator, a plurality of laterally-sliding doors, motor-controlling means, a lock for said controlling means, a wire extending past said doors and arranged to control said lock, a plurality of clips adjustably attached to said wire, a plurality of door-controlled levers, and yielding means connecting each lever with one of said clips.

7. In an elevator, a pilot-valve for controlling the main valve of the hoisting mechanism, a locking member connected to a movable part of said pilot-valve, a lock arranged to engage said locking member, a line connected to said lock to hold it out of engagement with said member, a counterbalance for said line and said lock, a plurality of elbow-levers, connections between said levers and said line, and a plurality of laterally-sliding doors directly engaging said levers.

8. An attachment constituting part of a safety appliance for elevators, the same consisting of a plate having a pivot-stud, and two lugs or stops, a lever fulcrumed on said stud and having an arm lying between said lugs

or stops, and a spring detachably secured to one of said lugs and to said lever, said parts being constructed and arranged whereby said lever can be reversed and the spring attached to the other of said lugs.

9. In an elevator safety appliance, a lock for the motor-controlling means, a line for controlling said lock and governed by the doors, a two-armed lever from one arm of which the line depends, and a weight adjustably secured to the other arm, which is notched to receive it.

10. A locking device for a motor-controlling line having stops, the same consisting of a casing having an aperture adequate to permit the passage of said stops, a yieldingly-operated locking-plate adapted to close said aperture and engage one of said stops, and means for operating said plate, said means consisting of two oppositely-acting weights.

11. In an elevator the combination with a line having stops, a casing having an aperture adequate to permit the passage of said stops, a yieldingly-operated locking member adapted to partially close the said aperture, a weight for moving said member to operative position, and a superiorly-weighted device controlled by the door, for holding the member in inoperative position.

12. A locking device for a motor-controlling line having stops, the same consisting of a casing having an aperture adequate to permit the passage of said stops, a yieldingly-operated locking-plate adapted to partially close said aperture and engage one of said stops, and means for operating said plate, said means consisting of two oppositely-acting weights, each being pivotally mounted and engaging said plate, one of said weights being greater than the other.

In testimony whereof we have affixed our signatures in presence of two witnesses.

EDWARD L. HAIL.
GEORGE HAIL.

Witnesses:
CHARLES A. HARKNESS,
GILMAN E. JOPP.

No. 659,493. Patented Oct. 9, 1900.

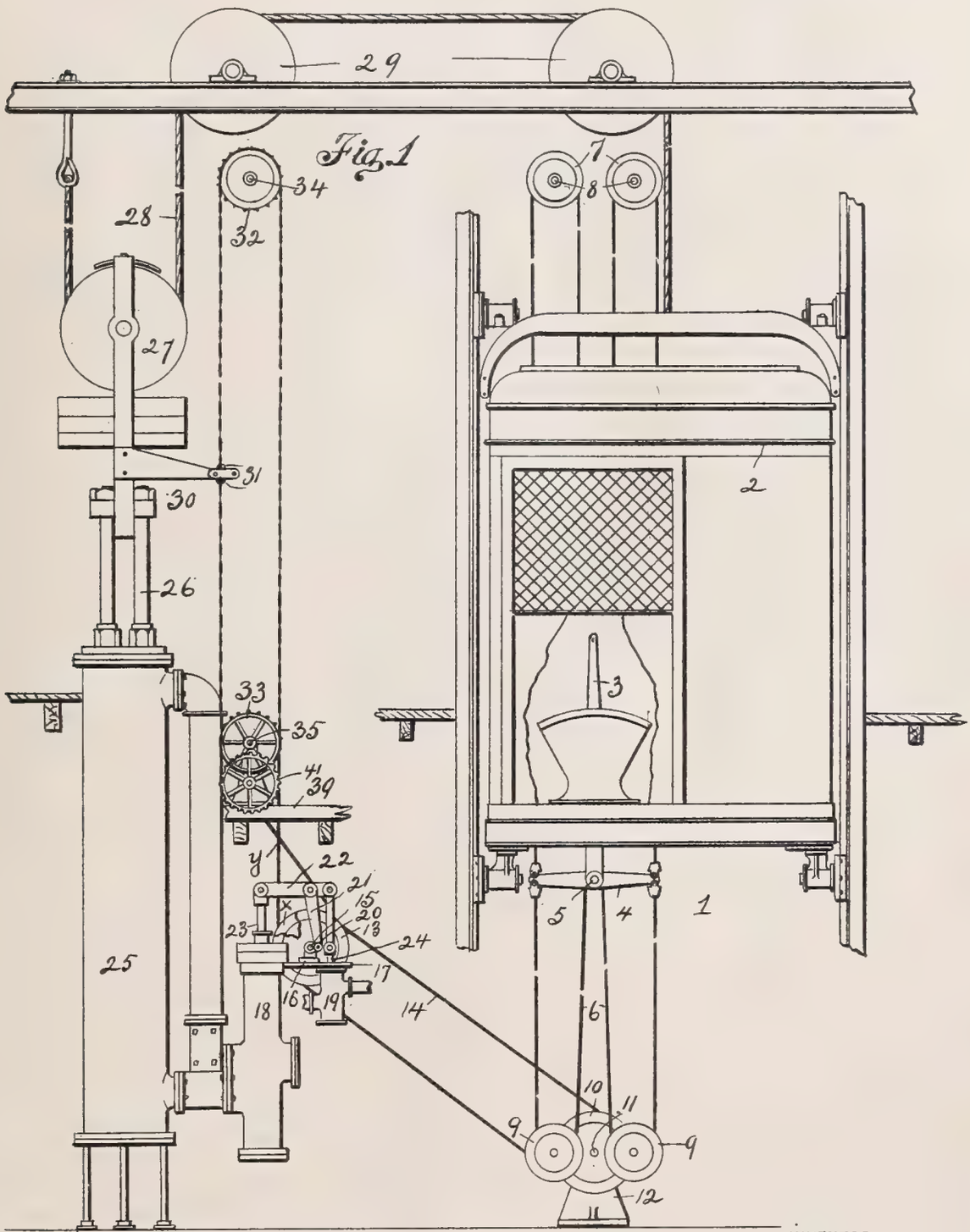
G. E. SHEPLER.

SAFETY DEVICE FOR ELEVATORS.

(Application filed June 3, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1



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(No Model.) 2 Sheets—Sheet 2.

Fig. 2

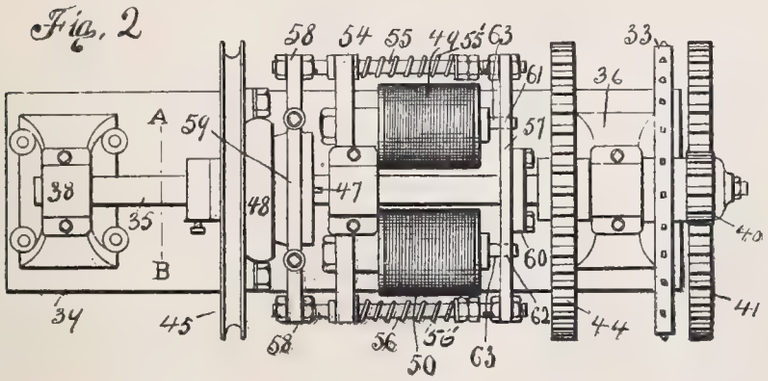


Fig. 3

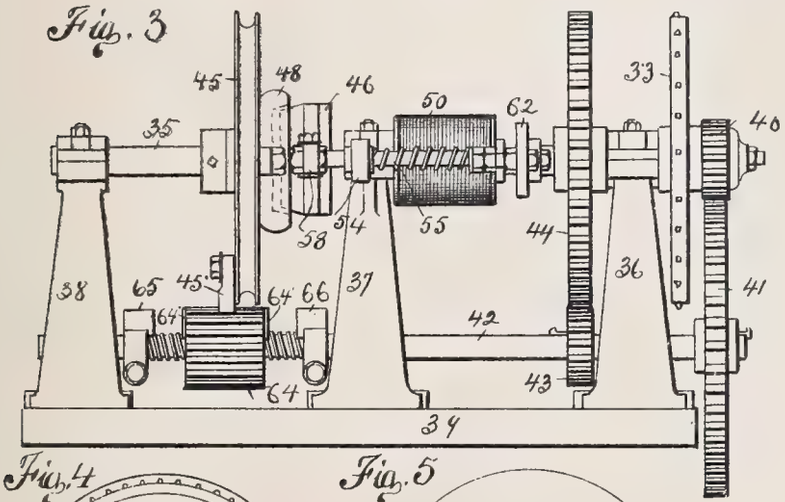


Fig. 4

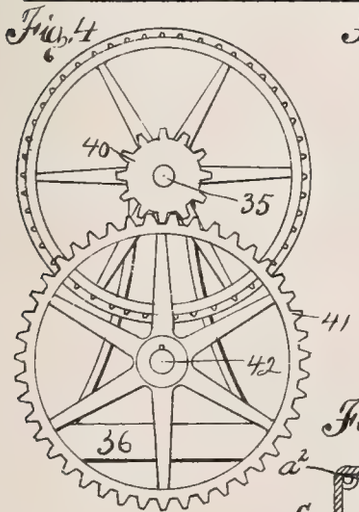


Fig. 5

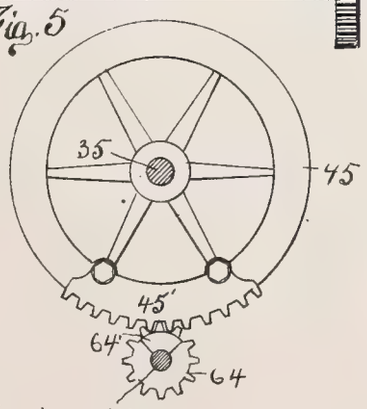


Fig. 7

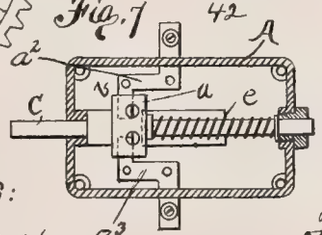


Fig. 6

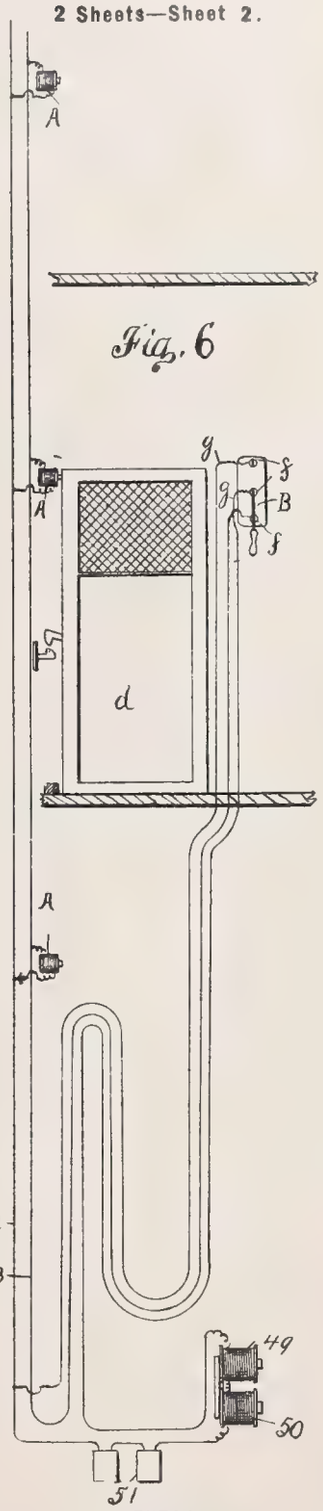
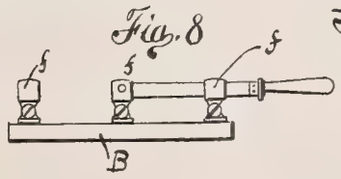


Fig. 8



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SAFETY DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 659,493, dated October 9, 1900.

Application filed June 3, 1899. Serial No. 719,201. (No model.)

To all whom it may concern:

Be it known that I, GEORGE E. SHEPLER, a citizen of the United States of America, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Safety Devices for Elevators; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form a part of this specification, in which—

Figure 1 indicates a side elevation of a portion of elevator-shaft with carriage therein and side elevation of the ordinary hydraulic mechanism for operating the same; also, end view of my improved device for automatically stopping the car by the opening of a door or doors in the elevator-shaft. Fig. 2 is a plan view of my improved device for automatically stopping the operating mechanism of elevators. Fig. 3 is a side elevation of the same. Fig. 4 is an end view of the same. Fig. 5 is a sectional elevation on line A B of Fig. 2. Fig. 6 is a diagrammatic view of electric circuits. Fig. 7 is an enlarged view of elevator-shaft switch. Fig. 8 is a side elevation of car-switch.

My invention relates to apparatus for automatically stopping the operating mechanism of elevators by the opening of a door or doors in the elevator-shaft and maintaining the same inoperative so long as the door or doors remain open.

One object of my invention is to produce a device by the use of which the operating mechanism of the elevator is stopped in the event of opening any of the doors in the elevator-shaft and held in an inoperative position so long as any of said doors remain open.

Another purpose of my invention is to prevent the elevator-carriage sinking below the level of the floor by leakage in the piston or valves. It is also adapted to cut off or stop the operating mechanism when the carriage arrives at either end of the elevator-shaft; and to these purposes my invention consists in the novel construction and arrangement of parts hereinafter more specifically described, reference being had to the accompanying drawings, which form a part of this specification, in which like reference characters indicate like parts wherever they occur

Referring to the accompanying drawings, 1 is the elevator-shaft, having therein arranged in the usual manner a carriage 2, adapted to be controlled by the controller-lever 3, which is connected at its lower end to the cross-bar 4, mounted on the shaft 5. To the ends of said cross-arm 4 a controller-rope 6 is connected or attached. The said rope passes over sheaves 7 7, mounted on shafts 8, arranged in the top of the elevator-shaft, and sheaves 9 9, which are mounted on the large sheave 10, which sheave is mounted on the shaft 11, journaled in bearings in the standard 12, arranged in the bottom of the elevator-shaft. When said controller-rope 6 is actuated by said lever, the sheave 10 makes a partial revolution, dependent upon the direction in which the lever is thrown. The motion of said sheave 10 is transmitted to the wheel 13 by means of the rope 14, which passes over said wheel and sheave 10. The said wheel 13 is is mounted on the shaft 15, which is suitably journaled in bearings formed in the standard 16, located on a platform 17, between the main-valve chamber 18 and the auxiliary-valve chamber 19. To one end of said shaft 15 a small crank 20 is secured and to which the lower end of a link 21 is connected. The upper end of said link is pivotally secured to the horizontal lever 22, the ends of which, respectively, are pivotally connected to extensions of the piston-rods 23 24 of the main and auxiliary valves, respectively, which are located in the main and auxiliary valve chambers, respectively. Motion communicated to said wheel 13 is thus transmitted to said crank for the purpose of opening and closing said main and auxiliary valves to admit and shut off pressure to the hydraulic cylinder 25, connected therewith. As this mechanism is the usual mechanism employed for operating hydraulically-driven elevators, I need not enlarge upon the same.

The upper end or extension of the piston-rod 26 of the hydraulic cylinder is provided with a wheel 27, under which the elevator-suspending rope 28 passes, said rope passing over and being supported upon large sheaves 29 and being finally secured in the top of the elevator-carriage. The extension 26 of said hydraulic-cylinder piston-rod is provided with a bracket 30, which projects laterally there-

from and to which the ends of the sprocket-chain 31 are secured. The length of said sprocket-chain coincides with the stroke of the hydraulic piston. The said sprocket-chain passes over sprocket-wheels 32 and 33, respectively, which are respectively mounted on the shafts 34 and 35, arranged, respectively, in the top of the elevator-shaft and in the standards 36, 37, and 38, the said standards being suitably secured to the platform 39. The sprocket-wheel 33 is loosely mounted on the end of said shaft 35, which is, as heretofore stated, journaled in bearings formed in the upper ends of said standards. 40 is a spur-wheel which is attached to or integral with said sprocket-wheel 33 for the purpose of transmitting power to the large spur-wheel 41, rigidly secured upon the shaft 42, journaled below said shaft 35 in bearings formed in said standards 36, 37, and 38. Power is thus transmitted to the shaft 35 by means of the small spur-wheel 43, which meshes with the large spur-wheel 44, mounted on the shaft 35. Power is then transmitted to the sheave 45, which is loosely mounted on said shaft 35 by means of a clutch, which consists of the male part 46, mounted on said shaft 35 by means of a spline, which projects in a slot 47 in said shaft, and the female part 48, which is an integral part of said sheave 45 or may be rigidly connected thereto. The said clutch is actuated by the magnets 49 50 when the same is energized by electric current conveyed from a battery 51 or other source of electric supply through the conductors 52 53. The said magnets are bolted to or otherwise suitably supported upon a yoke or bracket 54, which is secured to the top of the standard 37. The ends of said yoke are provided with orifices through which the rods 55 56 project and on which are mounted spiral springs 55′ 56′, the retraction of which disengages said clutch when said magnets are deënergized. The ends, respectively, of said rods are connected to the armature 57 of said magnets and to the brackets 58 58, which carry a collar 59, seated in a recess formed in the periphery of the male part of the clutch. The armature 57 is provided with a non-magnetic bearing 60, through which the shaft 35 projects, and is also provided with orifices 61 62, in which a non-magnetic pin 63, connected to the cores of said magnet, projects for the purpose of serving as a guide. The said sheave 45 transmits motion to a supplemental valve-wheel x on the valve-shaft 15 by means of the rope or cable y, whereby pressure is shut off from the cylinder and the operating mechanism held inoperative so long as said clutch is in engagement.

The lower end of the sheave 45 has secured thereto a segmental gear 45′, which meshes with the toothed pinion 64, which is mounted upon the inner threaded end of shaft 42, the said pinion being internally threaded, whereby when said shaft is rotated said pinion is caused to move from and toward the abutments 65 66, rigidly fastened upon said shaft. The ends of said pinion are provided with recesses 64′, whereby when said pinion travels a sufficient distance on the threaded end of shaft 42 to engage either of said abutments the said pinion is held rigid on the shaft and caused to rotate therewith, revolving the sheave a distance sufficient to transmit motion to the sheave x on the valve-shaft 15 by means of the rope y, thereby operating the valves to shut off pressure to the cylinder, as hereinafter described, for the purpose of stopping the mechanism. The shaft 42 is so threaded and driven at a speed graduated thereto that the car performs its upward journey and downward journey within the same period that the pinion is caused to travel between the abutments.

A indicates a series of switches located in the elevator-shaft at every landing. The said switch comprises a contact-plate a, which is secured upon the insulator b and is carried by a pin c, the outer part of which projects toward the door or doors d in the elevator-shaft. A small spiral spring e is mounted on said pin on the inner end of the same for the purpose of moving the plate a into or against the contacts a^2 a^3 when the door is opened.

Within the car I locate an emergency-switch B, having three contact-buttons f f f for the purpose of energizing said magnets through the medium of an auxiliary circuit independently of the movement of the door or doors, comprising the conductors g g, as hereinafter specified, for the purpose of operating the shut-off mechanism in the event of the controller-rope breaking or other accident occurring to the operating mechanism of the elevator.

The operation of my device is as follows, to wit: The door being open, as shown in Fig. 6, the retraction of the spring carries the contact-plate against contacts a^2 a^3, which closes the circuit and permits electric current to pass from the batteries or other source of electric supply to and through the magnet, energizing the same and attracting the armature thereof, thereby compressing the springs which are mounted upon the rods which connect the armature with the male portion of the clutch, moving said male portion into engagement with the female portion of said clutch, thus rigidly fastening the sheave which is integral with the female portion of the clutch upon the power-shaft and transmitting motion to the sheave x on the valve-shaft by means of the rope y, closing the valves which admit pressure to the cylinder and holding the same closed so long as the door remains open and preventing the operator from throwing his lever in any direction until the door is closed, upon the happening of which the circuit is broken and the spring on the armature-rod releases the clutch mechanism and permits the operator to throw his lever in whichever direction he may desire.

In the event of any accident happening to

the controller-rope or other circumstance that would place the car beyond the control of the operator the operator by throwing the emergency switch B to the upper contact transmits electric current to the auxiliary circuit to the magnets, energizing the same and stopping the car, as heretofore set forth.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination with an elevator-cage, a door at a landing, a hydraulic cylinder having a piston operatively connected to the cage, valve mechanism for controlling the flow to the hydraulic cylinder, and controlling mechanism on the cage for governing the valve mechanism, of a safety controlling apparatus, for automatically stopping the cage, comprising mechanism operatively connected to the valve mechanism aforesaid but normally unaffecting it, means for operating the safety mechanism by the movement of the piston, and electrically-controlled means, governed by the door, for rendering the safety mechanism operative with respect to the valve mechanism.

2. The combination with an elevator-cage, a door at a landing, a hydraulic cylinder having a piston operatively connected to the cage, valve mechanism for controlling the flow to the hydraulic cylinder, and controlling mechanism on the cage for governing the valve mechanism, of a safety controlling apparatus, for automatically stopping the cage, comprising a power-shaft which is driven by the movements of the piston in the hydraulic cylinder, a sheave mounted loosely on said power-shaft, and operatively connected with the valve mechanism, a clutch for locking said sheave to the power-shaft, an electromagnet for operating said clutch, and circuit connections with the door whereby the magnet is energized.

3. The combination with an elevator-cage, a door at a landing, and mechanism for raising and lowering the cage, of electromagnetic mechanism governing the raising and lowering mechanism, a circuit to the door which is closed on the door becoming open, an independent switch on the cage, and circuit connections with the electromagnetic mechanism whereby the closing of the switch will energize the electromagnetic mechanism which will cause a stoppage of the cage.

4. In a safety device for controlling the movement of elevator-carriages, the combination of a shaft, a door opening therein, a hydraulic cylinder having a piston therein, means to connect said piston with the carriage, a sprocket-wheel loosely mounted on the power-shaft, a second shaft adjacent said power-shaft, means to transmit power from said sprocket-wheel to said second shaft, means to transmit power from said second shaft to said power-shaft, a sheave loosely mounted on the power-shaft and adapted to transmit power to a supplemental sheave on the valve-shaft, a pair of magnets arranged horizontally with reference to said power-shaft, a clutch mechanism on said power-shaft adapted to be controlled by said magnets and to rigidly fasten said sheave upon said power-shaft, the said sheave being provided with a segmental gear secured upon the lower periphery, a pinion upon the threaded end of the second shaft adapted to engage with said segmental gear, and abutments arranged on said second shaft adapted to engage said pinion, substantially as set forth.

5. A safety device for controlling elevator-cages, comprising a power-shaft equipped with means for driving the same, a wheel loose on the shaft which is provided with a clutch member, a yoke or bracket, electromagnets secured thereto, rods slidable through the yoke and provided with a cross connecting piece or bracket, and a clutch member thereon which is adapted to engage the clutch member on the wheel, an armature connecting the rods, and springs for retracting the rods and armature, said clutch member on the yoke being slidably splined on the shaft and rotatable in the yoke.

6. A safety device for controlling elevator-cages, comprising a power-shaft, a driving-wheel loose thereon, a sheave loose on the shaft which is provided with a clutch, a yoke or bracket, electromagnets secured thereto, rods slidable through the yoke and provided with a cross connecting piece or bracket and a clutch thereon which is adapted to engage the clutch on the wheel, an armature connecting the rods, and springs for retracting the rods and armature, said clutch on the yoke being rotatable therein and slidable on a spline on the shaft, a second shaft having a gear which meshes with the gear on the driving-wheel aforesaid, gearing connecting the two shafts, screw-threads on the second shaft, a pinion adapted to turn on said threads, a segmental gear on the sheave meshing with the said pinion, and abutments on the second shaft adapted to engage and lock said pinion at the limits of its movements.

In testimony whereof I have hereunto affixed my signature in the presence of two subscribing witnesses.

GEORGE E. SHEPLER.

Witnesses:
CLARENCE A. WILLIAMS,
JNO. H. RONEY.

No. 663,953. Patented Dec. 18, 1900.

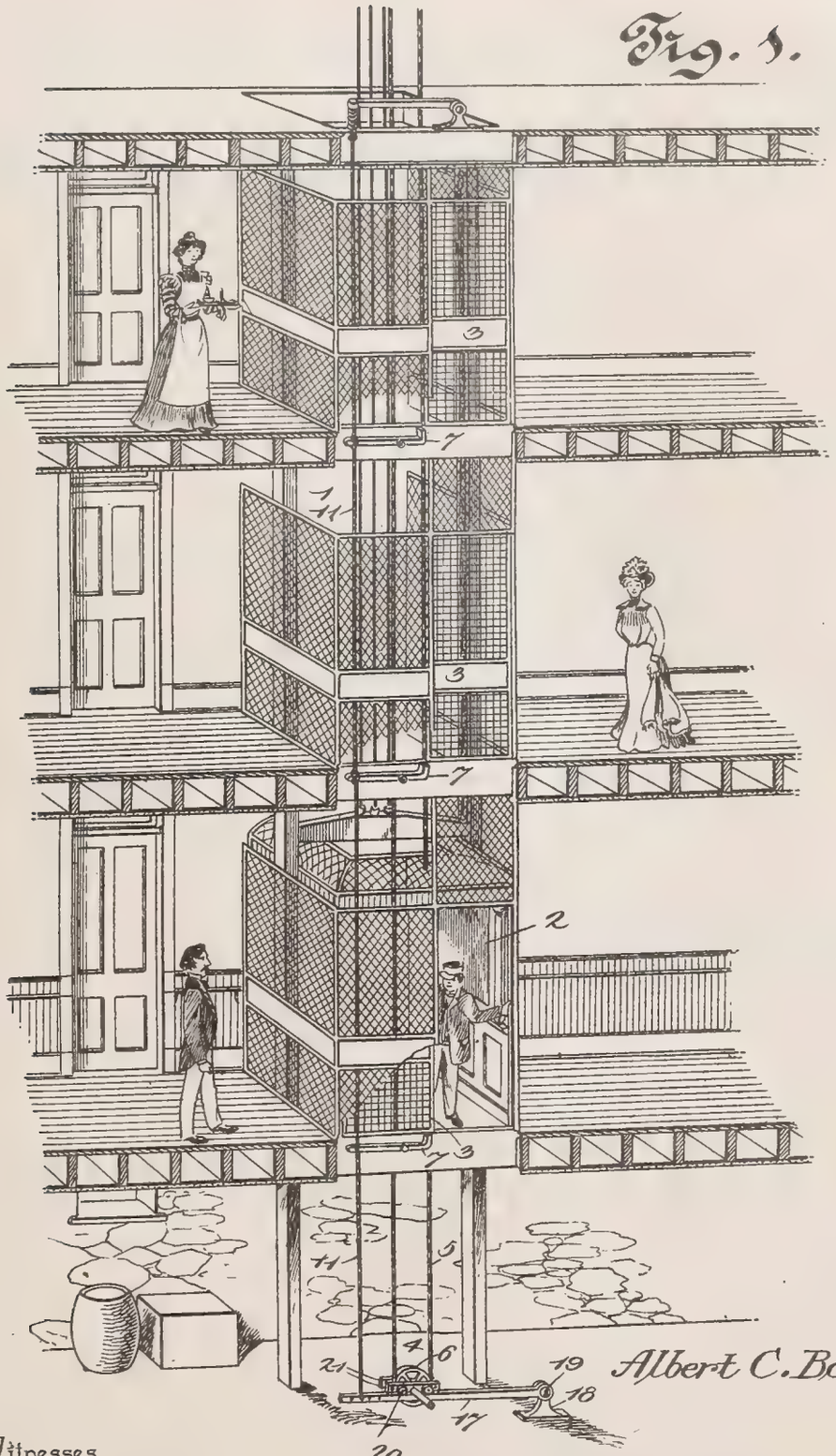
A. C. BOOTH.

ELEVATOR GATE.

(Application filed Sept. 10, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



Witnesses
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J. W. Garner

Albert C. Booth,
Inventor.

By C. A. Snow & Co.
Attorneys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 663,953. Patented Dec. 18, 1900.

A. C. BOOTH.

ELEVATOR GATE.

(Application filed Sept. 10, 1900.)

(No Model.) 2 Sheets—Sheet 2.

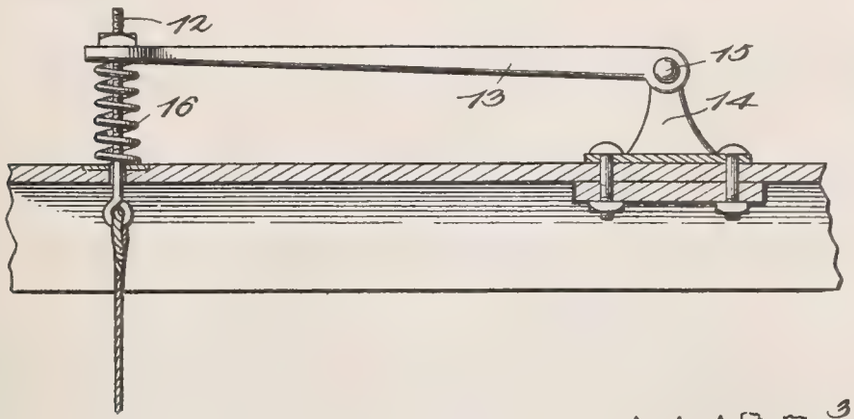


Fig. 2.

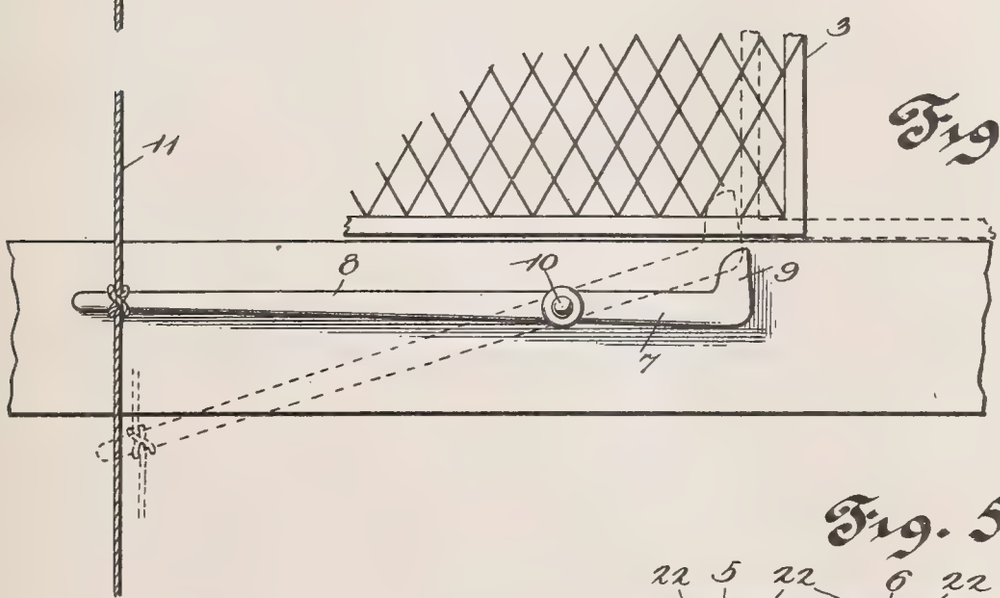


Fig. 3.

Fig. 5.

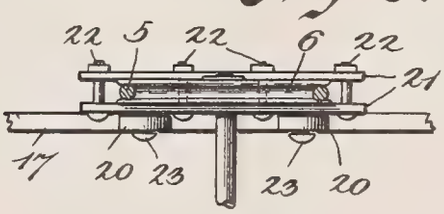
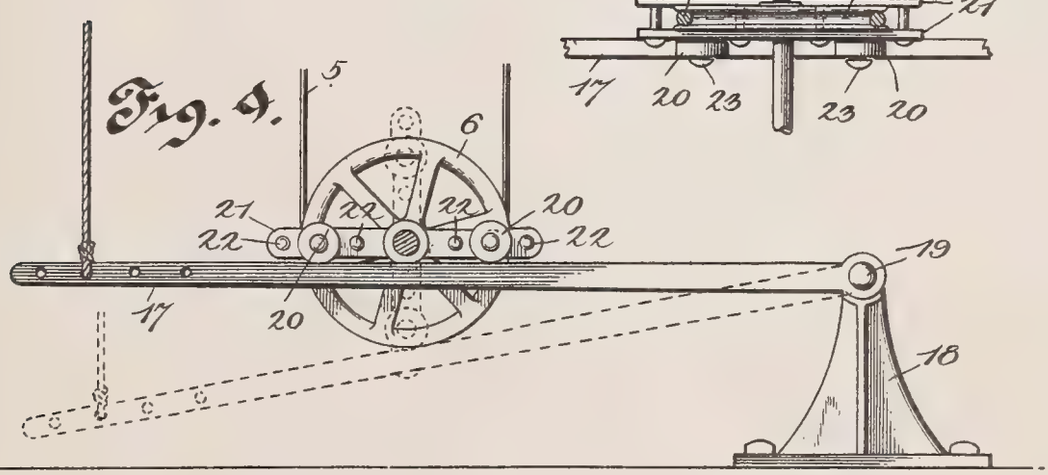


Fig. 4.



Albert C. Booth,

Inventor.

Witnesses
J. Frank Culverwell.
J. W. Garner

By C. A. Snow & Co.
Attorneys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ALBERT C. BOOTH, OF CEDAR RAPIDS, IOWA, ASSIGNOR OF TWENTY-THREE FIFTIETHS TO WILLIAM H. DUTTON, OF SAME PLACE.

ELEVATOR-GATE.

SPECIFICATION forming part of Letters Patent No. 663,953, dated December 18, 1900.

Application filed September 10, 1900. Serial No. 29,578. (No model.)

To all whom it may concern:

Be it known that I, ALBERT C. BOOTH, a citizen of the United States, residing at Cedar Rapids, in the county of Linn and State of Iowa, have invented a new and useful Elevator-Gate, of which the following is a specification.

My invention is an improved safety device for elevators, the object of my invention being to provide means operated by an elevator-door whereby when the door is open the controlling mechanism which starts the elevator-car cannot be operated, thereby preventing the car from being started until after the door has been closed.

My invention consists in the peculiar construction and combination of devices hereinafter fully set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a perspective view of an elevator provided with my improved safety devices. Figs. 2, 3, and 4 are detail elevations of the respective elements of my invention, showing the same disposed in operative position. Fig. 5 is a detail top plan view of the controller-wheel.

The elevator well or shaft 1, the elevator-car 2, the doors 3 at the various landings, the mechanism for raising and lowering the car, and the controller 4 are of the usual or any suitable construction. The controller includes the rope 5 and the sheave or wheel 6. The latter is hereinafter referred to as the "controller-wheel" and may be either directly or indirectly connected to the valve-gear or other mechanism for starting, stopping, and reversing the motion of the car. The controller-rope 5 is, as usual, disposed in the shaft or well and passes through the car.

The doors 3 on the various landings are disposed in the same vertical plane, and below each doorway in the embodiment of my invention here shown is disposed a pivoted bolt 7, which comprises an outwardly-extending arm 8 and an engaging shoulder 9, the bolt being pivoted, as at 10. In Fig. 3 of the drawings the door is shown in full lines as being open, and it will be observed that the door when open moves directly above the bolt, the latter being disposed just below the path of the door and out of the way thereof when the bolt is in the horizontal position shown in full lines in Fig. 3. When the door is closed, which position is indicated in dotted lines in Fig. 3, the bolt may be turned on its pivot, so as to raise its shoulder 9 and engage the same with the inner edge of the door, and thereby lock the door in a closed position. The locking position of the bolt is indicated by dotted lines in Fig. 3.

The bolts are connected together in series by a cord or rod 11. The upper end of the cord or rod which connects the locking-bolts together is attached to a vertically-movable eyebolt 12, which depends from the free end of a pivoted rocking arm 13, the latter being pivoted on a support or standard 14, as at 15. A spring 16, which surrounds the shank of the bolt 12, bears under the free end of the hanging arm 13, the function of the said spring being to normally raise the said arm and the series of locking-bolts attached thereto to the normal position shown in Figs. 1, 2, and 3, with the locking-bolts disengaged from the doors 3. The lower end of the cord or rod 11 is attached to a lever 17, which is mounted on a suitable support 18, as at 19, the said lever being disposed in the bottom of the elevator shaft or well and below and in proximity to the controlling-wheel 6. The latter is provided with tappets 20, which when the wheel is partly rotated by the operation of the controller-rope to start the car in either direction depresses the lever 17, thereby drawing down on the rod or cord 11, and hence turning the locking-bolts on their pivots. In the event that all of the doors are closed the said bolts may be thus turned to their locking positions to prevent the doors from being opened while the car is in motion; but if the door at the landing at which the car happens to be has not been entirely closed before attempting to start the car the initial movement of the controlling-rope will cause the locking-bolt to engage the lower side of the door, and hence the controlling-rope cannot be operated and the car cannot be started until the door has been closed and the bolt cleared.

To enable my improved safety appliances to be employed in connection with existing

elevators, I have devised means for attaching tappets to the controlling-wheels of existing elevators, the said means comprising a pair of bars 21, which are clamped to opposite sides of a controller-wheel by means of connecting-bolts 22. The tappets 20 are journaled on bearing-studs 23, which project from the face of one of the clamp-bars 21.

While I have herein shown and hereinbefore described my locking-bolts as being located below the doors, it will be understood that they may be placed above the doors or otherwise located with relation thereto without impairing the efficient operation thereof.

Having thus described my invention, I claim—

1. The combination with an elevator-door, of a pivoted bolt having a shoulder to engage and lock the door when the latter is closed, said bolt being locked by the door when the latter is open, a lever connected to the said pivoted bolt, and a controller, the latter also operating the said lever, whereby when the door is open said controller is locked by said bolt and lever, substantially as described.

2. The combination with an elevator-door, of a bolt to lock said door when closed, a controller, a lever operated by the controller and connected to the bolt, the latter when the door is open serving to lock said controller and when the door is closed serving to lock said door, substantially as described.

3. The combination with an elevator-door, of a bolt to lock said door when closed, a controller-wheel having tappets, a lever depressed by said tappets when said controller-wheel is operated, connections between said lever and bolt and a spring to normally disengage said bolt from said door, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

ALBERT C. BOOTH.

Witnesses:

WM. G. CLARK,

JAMES W. CLARK.

No. 667,281. Patented Feb. 5, 1901.

I. ALLOWAYS & J. RAMSAY.

ELEVATOR.

(Application filed May 15, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

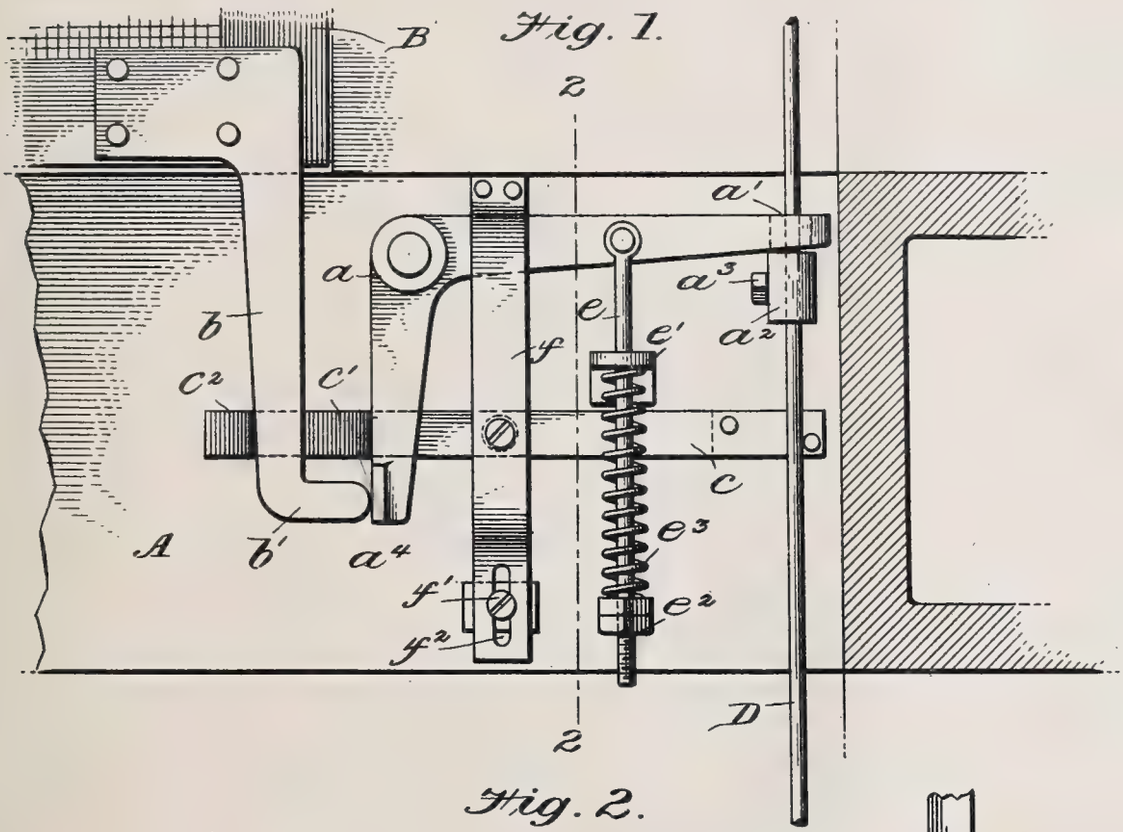


Fig. 2.

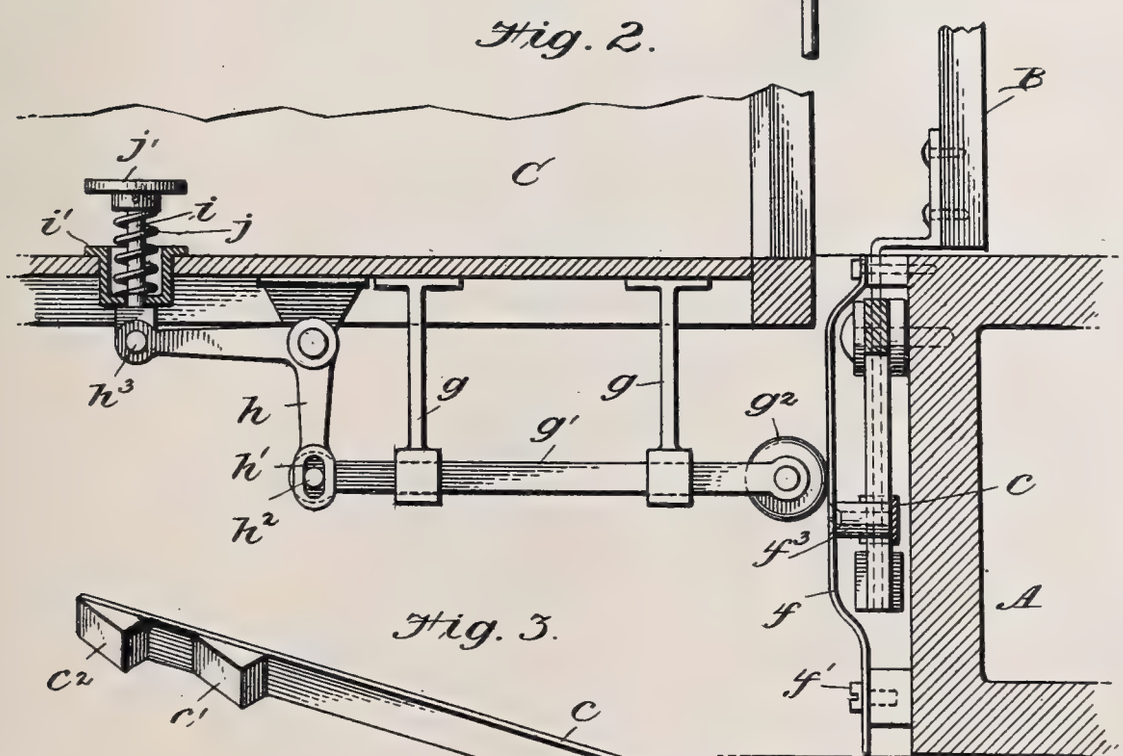
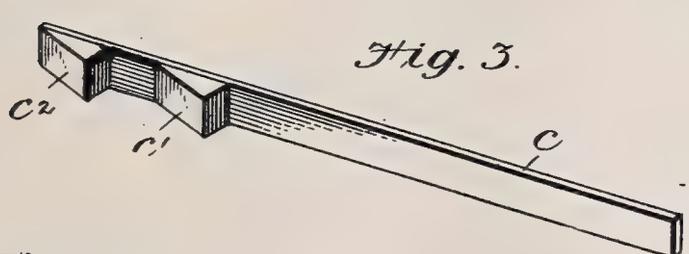


Fig. 3.



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Isaac Alloways
Jno. Ramsay

No. 667,281. Patented Feb. 5, 1901.

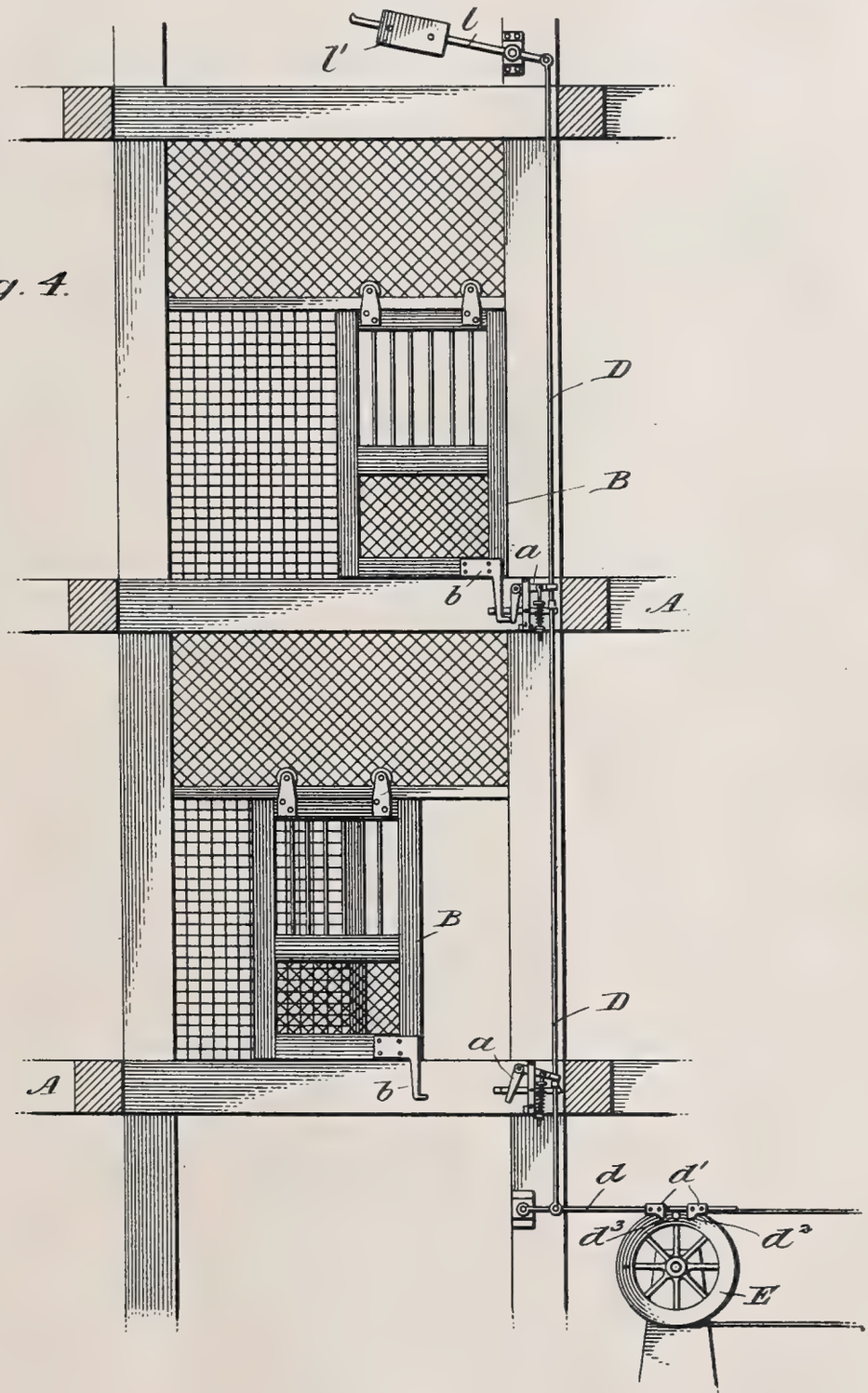
I. ALLOWAYS & J. RAMSAY.

ELEVATOR.

(Application filed May 15, 1900.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 4.



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Frank Feeney

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Jas. Ramsay

No. 667,281. Patented Feb. 5, 1901.

I. ALLOWAYS & J. RAMSAY.

ELEVATOR.

(Application filed May 15, 1900.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 5.

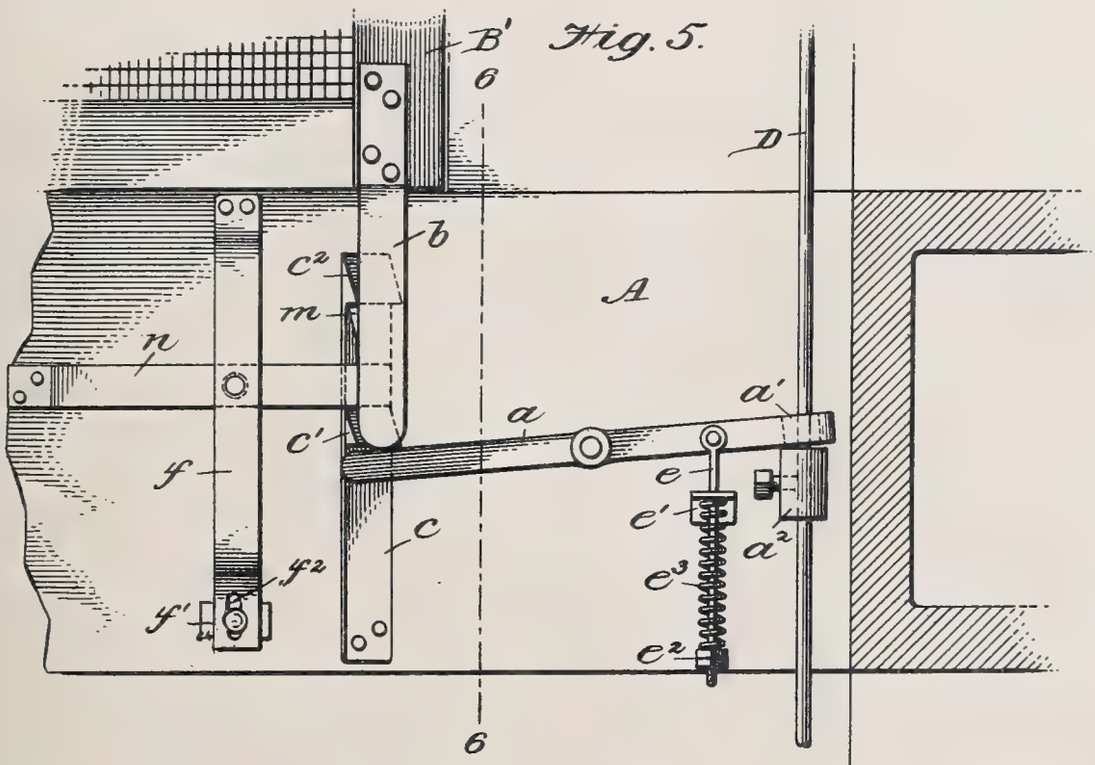
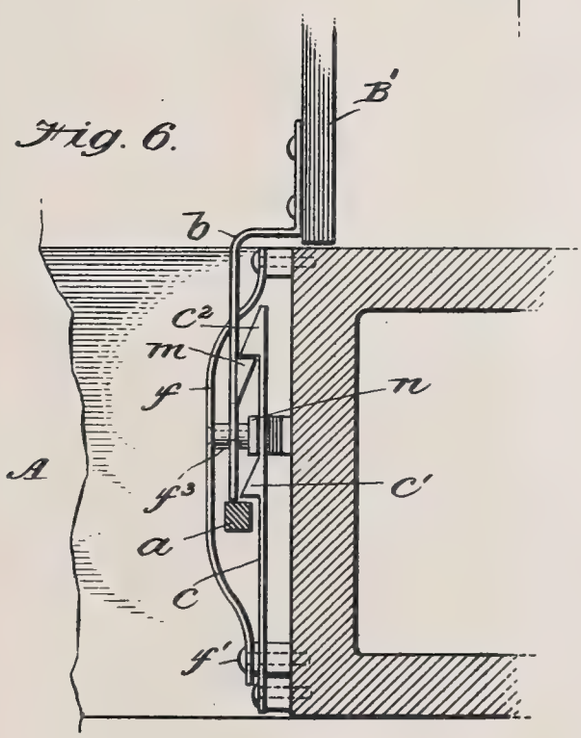


Fig. 6.



Witnesses.
Elton W. Lucas.
Frank Feeney

Inventors,
Isaac Alloways
Jn. Ramsay

UNITED STATES PATENT OFFICE.

ISAAC ALLOWAYS AND JOSEPH RAMSAY, OF PHILADELPHIA, PENNSYLVANIA.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 667,281, dated February 5, 1901.

Application filed May 15, 1900. Serial No. 16,741. (No model.)

To all whom it may concern:

Be it known that we, ISAAC ALLOWAYS and JOSEPH RAMSAY, citizens of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Elevators, of which the following is a full, clear, and concise description, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to certain improvements in elevators, and particularly to an automatic locking device such as hereinafter fully described.

The principal object of this invention is to provide mechanism for automatically locking the elevator-car against movement either up or down simultaneously with the opening of the landing-door, so as to prevent accidents due to the carelessness of the operator in starting the car while the door is open and leaving the door open after the car has passed the floor.

A further object of this invention is to provide mechanism for preventing the landing-doors from being opened either from the inside or outside of the hatchway until the car is at the proper position in front of the landing.

With these objects in view our invention consists in the construction and arrangement of the different parts, such as will be hereinafter fully described, and particularly pointed in the claims made hereto.

In order to enable others skilled in the art to which our invention most nearly appertains to understand and use the same, we will now proceed to describe it in detail, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of a portion of the hatchway of an elevator at the floor-line looking from the interior of said hatchway and illustrating a portion of the landing-door. Fig. 2 is a sectional elevation taken transversely to Fig. 1, about on the line 2 2 in said figure, showing a portion of the elevator-car directly opposite the landing. Fig. 3 is a detail perspective of a spring-latch which forms a part of the locking mechanism. Fig. 4 is a sectional elevation illustrating an elevator-hatchway showing two floors, the landing-door being open in one instance and closed in the other, while the elevator-controlling mechanism is locked against movement. Fig. 5 is a side elevation similar to Fig. 1, illustrating a modified construction for use on vertically-sliding doors, such as are used on freight-elevators. Fig. 6 is a section taken about on the line 6 6 of Fig. 5, transversely to the same.

The elevator-car and controlling mechanism may be of any of the well-known constructions, and this invention may be applied thereto without changing or altering the parts in any manner.

In said drawings, A designates the joist between the floors, B the landing-door, and C the elevator-car.

D is a metallic rod running the full length of the elevator-shaft, which is pivoted at its lower end to a transversely-arranged pivoted rod d, carrying near its free end the lugs d', which when the rod D is shifted downwardly serve to lock the operating-valve wheel E and prevent the operation of the motor mechanism until the rod d is raised. The lugs d' are rounded or cam-shaped on their lower faces, as shown at d^2, so that in the event of the rod d being dropped by accident, caused by the breaking of any of the mechanism or by reason of some one of the landing-doors being pried open, the pin d^3 on the valve-wheel E will act on said cam-faces and raise the lever sufficiently to allow the pin to assume the position shown in Fig. 4, which is the position assumed when the operating-valve is closed.

To the joist A, directly below the floor-line, is pivoted a bell-crank lever a, having provided in the end of its horizontal arm an eye a', through which passes the vertical rod D. Directly below this arm of the bell-crank is a sleeve or nut a^2, which surrounds the rod D and is secured rigidly thereon by means of a set-screw a^3. The vertical arm of the bell-crank a is provided on its lower end with an enlarged edge, as a^4, against which bears the lug b', formed on the arm b, which is secured to the lower forward corner of the landing-door B.

Secured at one end to the joist A is a spring-lever c, having two locking projections c' c^2 formed on its outer face near its free end, the one c' being adapted to engage the edge of the bell-crank a and hold it in normal position

and the one c^2 being adapted to engage the rear edge of the arm b and hold the door B closed and locked against movement until the latch c is depressed.

The horizontal arm of the bell-crank a has pivoted thereto about midway of its length a rod e, which passes through a bracket e', secured to the wall or joist A. The lower end of this rod is threaded and carries the jam-nuts e^2. Between the jam-nuts e^2 and the bracket e' is a stiff coil-spring e^3, under tension and adapted when the projection b' is removed from the end a^4 of the bell-crank to draw down the horizontal arm of said bell-crank, and thereby shift the rod D downwardly.

On the outside of the bell-crank a we provide a flat spring f, rigidly secured at its upper end to a projection carried by the wall or joist A and having its lower end secured by means of a bolt f', which passes through the slot f^2 and enters a block or projection formed on the joist A. Secured to the rear side of the spring f is a projecting boss f^3, which bears against the latch-lever c, so that when the spring f is depressed the lever c will also be depressed and the lower bell-crank arm a and arm b released from the locking projections c' and c^2.

On the bottom of the elevator-car we provide a pair of suitable hangers g, which support a sliding rod g', carrying on its outer end a roller g^2, adapted to bear on the outside of the spring f. A bell-crank lever h is pivoted to the bottom of the car C in front of the bracket g, having the lower end of its vertical arm provided with a slot h', which fits over a pin h^2, carried by the end of the sliding rod g'. The horizontal end of the bell-crank is pivoted at h^3 to a rod i, which passes up through the floor of the car C. A socket-plate i' is provided around the rod i for supporting the coil-spring j, the upper end of said spring bearing against the head j', carried by the upper end of the rod i. It will thus be readily seen and understood that as soon as the car C reaches a position in front of the landing-door B the sliding rod g', carrying the roller g^2, will be in about the center of the flat spring f, and the operator, by depressing the foot-rod i, causes the bell-crank h to operate and slide the rod g' and its roller g^2 against the spring f and depress the same. This movement depresses the latch-lever c through the medium of the projecting boss f^3 and releases the bell-crank a and also the depending arm b, carried by the landing-door B, and permits the said door's being opened. As soon as the door B is opened the depending arm b and its projection b' are moved away from the contact with the lower arm of the bell-crank a, and the spring e^3, carried by rod e, will operate to pull down the upper end of the bell-crank a. This action will cause the vertical rod D to be shifted downwardly by reason of the connection between said rod and the bell-crank. The downward movement of the rod D drops the lever d and stops and holds the controlling mechanism of the elevator in a locked position. The upper end of the rod D is pivoted to a lever l, located at the top of the elevator-shaft. This lever is pivoted to the wall of the elevator-shaft and carries on its free end a weight l', sufficiently heavy to counterbalance the weight on the rod D after said rod has been released by the bell-crank levers a, so that when the elevator-door is closed and the bell-crank returned to the position shown in Fig. 1 of the drawings the rod D will be returned to normal position and the elevator-running mechanism released from its locked position, so that the car can be operated.

From the foregoing description it will be readily seen that when the landing-doors are closed the motor or controlling mechanism which drives the elevator-car can be operated at will and all of the said doors are locked securely against movement and can only be released by the mechanism carried by the floor of the car. This mechanism will only operate to release said doors when the car-floor is on a level with the landing-floor or within a very short distance of the same. When this position is reached, the operator only has to compress the foot-piece j, when the locking mechanism of the door is immediately released, and simultaneously with this operation the controlling mechanism of the elevator is locked against movement, thus completely preventing the car from being moved either up or down until the landing-door has been again closed. The reclosing of the door immediately releases the elevator-controlling mechanism and the car is again at liberty to move in either direction at the will of the operator.

In Figs. 5 and 6 of the drawings we have shown a slightly different arrangement of mechanism, the same being adapted to a vertically-moving door, such as ordinarily used for freight-elevators. In this construction the arm b, which is secured to the lower end of the door B', is provided on its inner side with a beveled lug m, adapted to engage a latch c^2, carried on the end of the spring-lever c, which in this instance is vertically arranged instead of horizontally, as in the previously-described construction. A spring-rod n, pivoted at one end, has its free end bearing against the latch-lever c, and in front of this rod n is a vertical spring-rod f, rigidly secured at its upper end to a block on the joist A, while its lower end is adjustably held by means of the pin f', passing through the slot f^2. A boss or sleeve f^3 is secured to the under side of this lever and bears against the spring-rod n. On the latch-lever c is a second lug c', which normally bears against the lever a, which is pivoted at about its center to the joist A. The other end of this lever a is provided with an eye a', through which passes the vertical rod D, which controls the motor mechanism in the basement. The nut

or collar a^2 is secured to the rod D below the lever a, as illustrated. The rod e is pivoted to the arm a and passes through the bracket e' and has on its lower end the jam-nuts e^2. Between the bracket e' and the nuts e^2 is the coil-spring e^3, all of which operate substantially as hereinbefore described. The car in this instance is equipped with the mechanism substantially as shown in Fig. 2 of the drawings and heretofore described. So it will not be necessary to again describe this mechanism. The operation of this modified form of our invention is substantially the same as in the first-described instance. When the car reaches the proper stopping place opposite the landing-door, the lever g' is operated by means of the foot-piece j' and the spring f is compressed, which action compresses the spring-rod n, and consequently depresses the latch-lever c, which releases the latch c^2 from the lug m, carried by the arm b, thereby leaving the door B' free to be raised and opened. As soon as the lever c is depressed the latch c' also moves away from over the free end of the lever a, and the spring e^3 will then immediately act to throw or pull down the end of the lever a which is secured to the rod D, and thus shift this rod downwardly and lock the elevator-controlling mechanism. As soon as the door is closed the arm b engages the free end of the arm a and throws this down to normal position, thus releasing the controlling mechanism by allowing the rod D to return to normal position through the action of the weight l'. The beveled lug m will again engage the latch c^2, while the latch c' engages the end of the arm a, thus securely locking the landing-door and allowing the elevator-car to again start.

We do not desire to limit ourselves to the precise details of construction illustrated and described herein, but hold that various slight changes might be made without departing from the spirit and scope of our invention.

Having thus fully described the nature of our invention, what we claim, and desire to secure by Letters Patent, is—

1. In an elevator, the combination of the car, controlling mechanism for running the same, a vertical rod extending the length of the elevator-shaft, mechanism connected with the said rod for locking the controlling mechanism, a lever pivoted to the wall of the shaft adjacent to the landing, a connection between the said lever and the vertical rod, a depending arm carried by the landing-door, mechanism for locking the pivoted lever and depending arm, mechanism operated from the elevator-car for unlocking the pivoted lever and depending arm simultaneously, and mechanism connected with the pivoted lever for actuating the same after it has been released to lock the car-controlling mechanism simultaneously with the opening of the landing-door, substantially as described.

2. In an elevator, the combination of the car, controlling mechanism for running the same, a vertical rod extending the length of the shaft, mechanism connected with the lower end of said rod for locking the controlling mechanism, a lever pivoted to the wall of the shaft having one end engaging the vertical rod, a depending arm carried by the landing-door, a latch-lever adapted to engage and lock the depending arm and the pivoted lever, means operated from the car for depressing said latch-lever to release the depending arm and pivoted lever, and a spring connected with the pivoted lever adapted to actuate the vertical rod and lock the car-controlling mechanism simultaneously with the opening of the door, substantially as described.

3. The combination with the driving mechanism of an elevator, a vertical rod extending the length of the elevator-shaft having connecting mechanism for locking the driving mechanism when said rod is shifted downwardly, a lever pivoted to the wall of the shaft below each landing-door having one end connected to the vertical rod, a spring adapted to throw said lever downwardly when the same is released, a depending arm carried by the landing-door, a spring latch-lever having one latch adapted to engage and hold the pivoted lever in normal position and a second latch adapted to engage and to hold the depending arm on the door, a projecting spring extending from the shaft-wall having a connection with the latch-lever, a sliding rod carried by the elevator-car, and mechanism for operating said rod to depress the projecting spring, substantially as described and for the purpose stated.

4. The combination with the driving mechanism of an elevator, a vertical rod extending the length of the shaft having a connection at its lower end with the driving mechanism whereby upon the shifting of said rod in a downward direction the driving mechanism is locked, a weight connected with the upper end of said rod adapted to return the same to normal position, a lever pivoted to the wall of the shaft at each landing having one connected to the vertical rod, a depending arm carried by the landing-door, a spring latch-lever adapted to engage the pivoted lever and the depending arm, a sliding rod carried by the elevator-car adapted when operated to actuate the latch-lever and release the depending arm and pivoted lever, and a foot-lever extending through the car-floor for operating the sliding rod, substantially as described.

5. The combination of the elevator-controlling mechanism, a vertical rod for locking and releasing the controlling mechanism, a bell-crank lever pivoted to the wall of the shaft below the landing, a connection between one arm of said lever and the vertical rod, a depending arm carried by the elevator-door, mechanism for locking the bell-crank lever and the depending arm, mechanism operated from the elevator-car for unlocking the bell-crank and the door-arm simultaneously, and

a spring adapted to act on the bell-crank lever and throw the same downwardly immediately after it has been released, for the purpose of shifting the vertical rod and locking the controlling mechanism of the elevator.

6. The combination with the vertical rod D, of mechanism connected with the lower end thereof for locking and releasing the elevator-controlling mechanism, a bell-crank lever *a* pivoted to the wall of the elevator-shaft below the landing, having one arm connected to the rod D, an arm *b* depending from the elevator-door, a spring-lever *c* secured at one end to the wall of the shaft, a pair of latches formed on said lever adapted to engage and lock the arm *b* and lower arm of the bell-crank when the landing-door is closed, mechanism operated from the elevator-car for unlocking the bell-crank and the door-arm simultaneously and a spring connected with the horizontal arm of the bell-crank adapted to throw the same downwardly when it has been released, for the purpose substantially as described.

7. The combination of the rod D having mechanism connected at its lower end for locking the controlling mechanism when the same is shifted, a bell-crank lever *a* pivoted to the side wall of the elevator-shaft, a slot *a'* formed in the end of the horizontal arm of said lever adapted to surround the rod D a collar a^2 secured on the rod D below the bell-crank arm, a depending arm *b* carried by the landing-door, a spring latch-lever secured at one end to the wall of the shaft having latches *c'* and c^2 adapted to engage the lower arm of lever *a* and the arm *b* respectively, a spring e^3 connected with the horizontal arm of the bell-crank, an outwardly-projecting spring *f*, connected near its center with the latch-lever *c* and mechanism operated from the elevator-car for depressing said spring and simultaneously unlocking the elevator-door and locking the controlling mechanism of the elevator, substantially as described.

8. The combination with the rod D of the pivoted bell-crank lever *a* having its horizontal arm connected to the said rod, a rod *e* pivoted to said bell-crank, a bracket *e'* secured to the wall of the elevator-shaft through which said rod *e* passes, lock-nuts e^3 threaded on the end of rod *e* a coil-spring interposed between the bracket *e'* and the nut e^2 depending arm *b* carried by the landing-door, a latch-lever *c* adapted to engage and lock said arm *b* and the lower end of the bell-crank, a bowed spring *f* extending in the front of the latch-lever, a connection between said bowed spring and the latch, and a lever *g'* carried by the car adapted when operated to press the spring *f* and release the latch-lever from engagement with the arm *b* and lever *a*, substantially as described.

9. In an elevator, the combination with the controlling mechanism, of a rod D running the length of the elevator-shaft, a rod *d* pivoted at one end having the rod D pivoted thereto, a wheel E connected with the operating device of the elevator, a projecting pin carried by said wheel, a pair of lugs or stops carried by the pivoted rod *d* having cam-shaped lower faces and mechanism connected with the rod D for locking the operating-wheel as the landing-doors are opened and for releasing the same when said doors are closed, substantially as described.

In witness whereof we have hereunto set our hands this 10th day of May, A. D. 1900.

ISAAC ALLOWAYS.
JOS. RAMSAY.

Witnesses:
ELTON W. LUCAS,
FRANK FEENEY.

No. 694,964. Patented Mar. 11, 1902.

F. HEIZER.

ELEVATOR.

(Application filed May 18, 1901.)

(No Model.) 2 Sheets—Sheet 1.

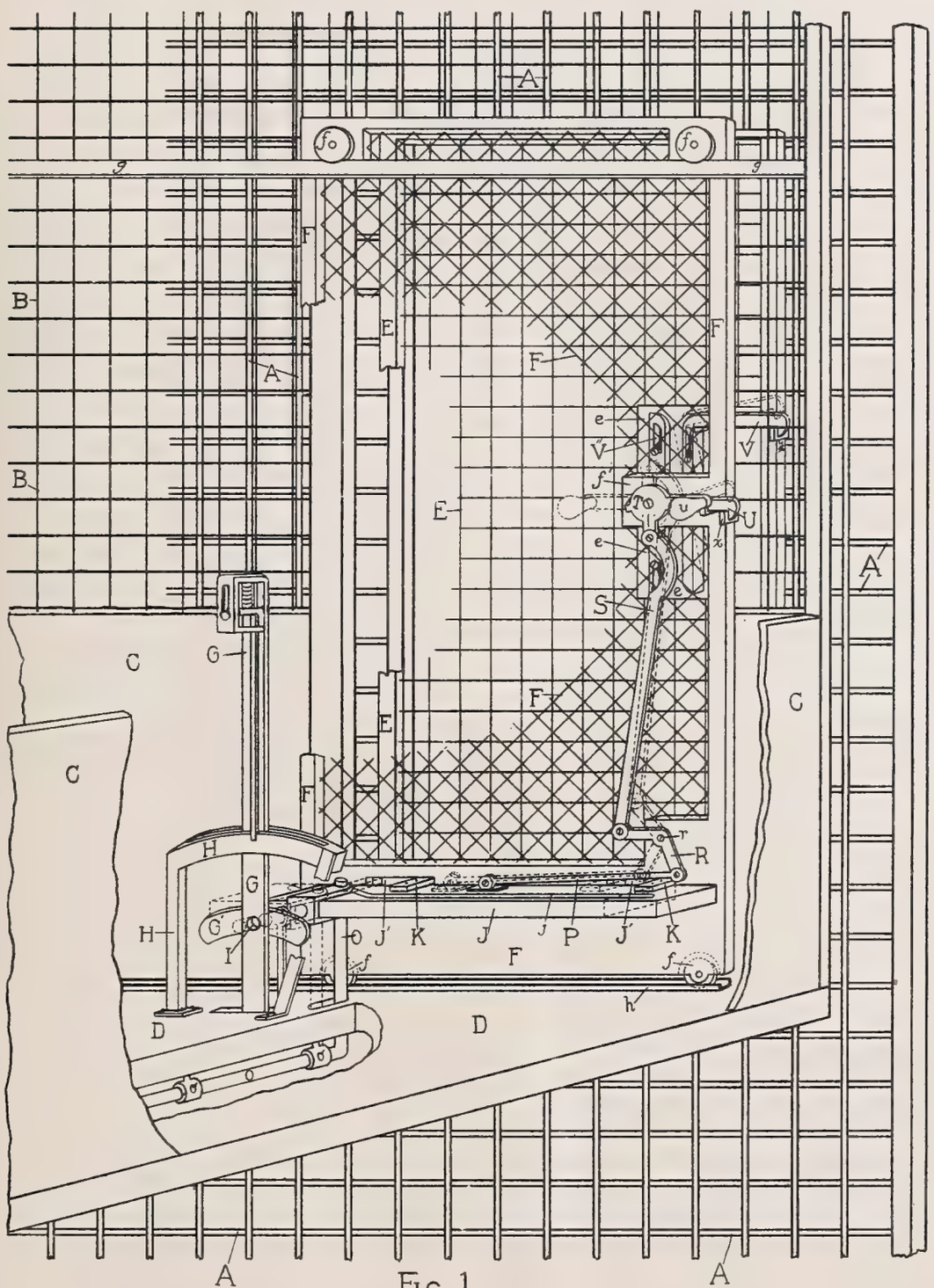


FIG 1.

WITNESSES:
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Grace G. Richardson

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F. Heizer,
BY H. C. Gardiner,
ATTORNEY.

THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

No. 694,964. Patented Mar. 11, 1902.

F. HEIZER.

ELEVATOR.

(Application filed May 18, 1901.)

(No Model.) 2 Sheets—Sheet 2.

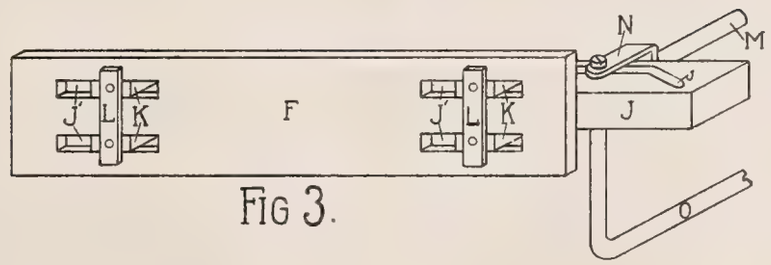

FIG 3.

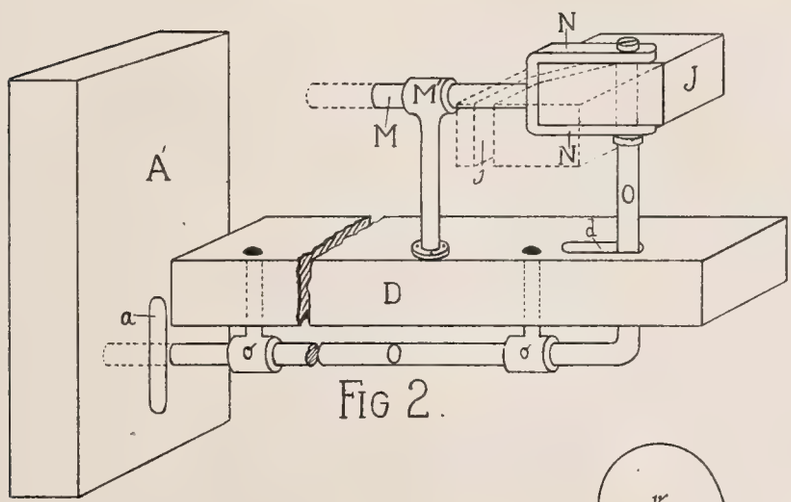

FIG 2.

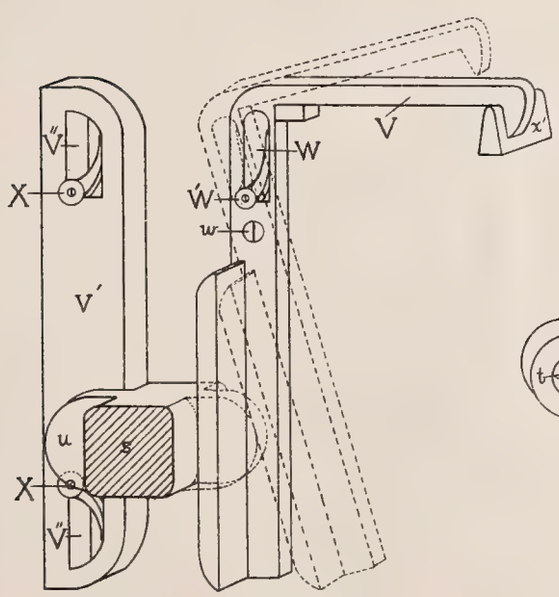

FIG 5.

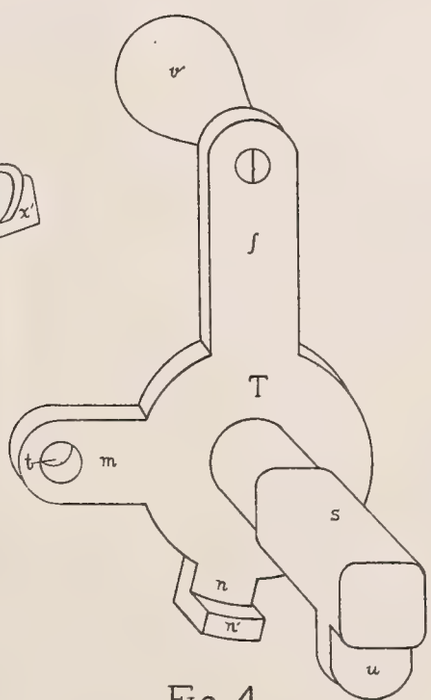

FIG 4.

WITNESSES:

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UNITED STATES PATENT OFFICE.

FREDERICK HEIZER, OF SIOUX CITY, IOWA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO JESSIE H. HEIZER, OF SIOUX CITY, IOWA.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 694,964, dated March 11, 1902.

Application filed May 18, 1901. Serial No. 60,861. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK HEIZER, a citizen of the United States, residing at Sioux City, in the county of Woodbury and State of Iowa, (whose post-office address is Sioux City, Iowa,) have invented a new and useful Improvement in Elevators; and I do declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to improvements in elevators for passengers or freight; and the objects are to provide means for securing the door of the elevator and locking the elevator in a given position to prevent its operation while the doors leading into it are open or may be opened, provision being thus made for preventing accidents which result from carelessness in the operation.

My invention consists in the novel construction, arrangement, and combination of the parts, as will be hereinafter fully described, and particularly pointed out in the claims.

I have fully and clearly illustrated my invention in the accompanying drawings, wherein—

Figure 1 is a view of section of elevator, showing doors of the same and my invention complete. Fig. 2 is a detail view showing section of floor of elevator and section of wall beside the elevator and bolts used in securing the elevator when the doors are open. Fig. 3 is an enlarged detail view showing another view of bolt and sliding bar used in its operation. Fig. 4 is an enlarged detail view of lever used to secure the door and to operate the bolts for locking the elevator. Fig. 5 is an enlarged view of latch used to secure the door to elevator-shaft, showing also a section of bolt for its operation.

Referring now to these illustrations, wherein like parts are designated by similar letters of reference, A designates the wire frame of shaft in which the elevator-cage moves up and down.

B designates the upper part of the elevator-cage, usually made of wire, as shown in the drawings.

C designates the lower part of the elevator-cage, composed of wood and solidly built, as herein shown.

D is the floor of the elevator-cage; E, the door to the elevator-shaft, constructed and adapted to open and close in the ordinary manner.

F is an inside door or door to the cage of the elevator, constructed like the door to the shaft, adapted to slide on rollers *f f* at the top and bottom of the door, the upper rollers moving upon a track *g* and the lower rollers in a groove *h*, the door being located directly opposite and contiguous to the door to the elevator-shaft. A door to the elevator-shaft is situated on each floor of the building, as ordinarily.

G is the hand-lever used in the operation of the elevator, and H is the slotted frame in which said lever works. A short distance above the floor of the cage a round hole I is made in the lever, and at this point an arc-shaped bar G′ is secured to the lever on the side contiguous to the elevator-door, said bar having a round hole in the center conforming to that in the lever, both holes forming a continuous opening.

J designates a flat bar of steel or other suitable material extending across the bottom of the door of the cage on the inside opposite the bar G′ and secured to the door in such manner as to be capable of a limited lateral movement. Two pairs of lugs K K are firmly secured to the upper and lower surfaces of the bar and extend outward through narrow slots J′ J′, cut in the door. The ends of the lugs are connected on the outside of the door by means of the bars L L, firmly secured to the lugs. The lugs are narrower than the slots and capable of sliding in them, Fig. 3. A narrow vertical slot *j* is cut through the bar J and extends nearly the length of the bar. The bar is attached to the door so that one end extends by the arc-shaped bar G′, and as the slot approaches the end of the bar it diverges outwardly, so that the portion of the bar between the slot and the inner edge of the bar is thicker at this point.

M designates a bolt, one end of which is adapted to fit the opening in lever G and bar G′, the other end of the bolt having forked extensions N N, embracing the upper and lower surfaces of the bar J, Figs. 2 and 3. The bolt is supported in a horizontal po-

sition by the post or brace M′, secured to the floor, and is adapted to move back and forth through the eye of said post.

O designates a round bolt or bar extending through the extremities of the forked extensions N N, through the slot *j*, and downward through a slot *d* in the floor of the cage. Underneath the floor it turns at a right angle under and parallel with the floor supported by the posts *o o*, secured to the floor, and is adapted to be pushed into a slot *a* in the wall A′ beside the cage, the vertical slot being provided to permit the operator some latitude in stopping the elevator, it being inconvenient to stop at a precise point. When the bar J is in such position that the upper part of the bolt O enters the divergent part of the slot *j*, the bolts M and O are pushed outwardly away from the bar G′ and the wall A′, and the elevator may be moved freely. When the bolt O enters the straight part of the slot *j*, the bolts M and O are pushed inwardly and are so situated and adjusted that the lower end of the bolt O enters the slot *a* and prevents the elevator from moving, while the bolt M enters the opening I, if the elevator is at rest, and the hand-lever G in a vertical position.

Pivotally secured at one end to the upper surface of the bar J at a point near the center of the bar outside of the slot *j* is a lever P, having pivotal connection at the opposite end with a short lever R, made in the shape of an obtuse angle. The lever R is pivotally secured near the angle to the inside of the door F at the point *r* at the lower corner of said door and near the edge at which the door is secured. One fork of said lever extends away from the edge of the door, while the other extends downward. To the other end of said lever R is pivotally connected a long rod S, extending upward and pivotally connected at the upper end with the latch-lever T. The upper end of said rod S is bent in the form of an arc, the arc extending toward the edge of the door. A lug *m* extends downward from the latch-lever, and to this lug the rod S is attached. The latch-lever T is pivotally secured to the plate *f*′, which forms a solid part of the door of the cage. The latch-lever T has a round central part, with a side extension *l* extending toward the edge of the door when the door is closed, and to the extension *l* is secured a convenient handle *v*. A bolt *s* is secured to the center of the round part of the lever T, forming the axis of said lever, and extends through the end of the latch U, which operates on said bolt, and outward through the plate *f*′ of the door. The part of the bolt which extends outward from the door is square, with rounded corners, the square part forming a shoulder, which prevents the bolt from slipping back. A lug *m*, having rounded corners, is cast on said bolt near the outer end of the square part and extends in an opposite direction from the extension *l*. On the round part of the lever T, nearly opposite the extension *l*, is a short extension *n*, having a square-cornered lug *n*′, extending in the same direction as the bolt *s*. When the latch-lever is raised and turned over, as will be presently described, the lug *n*′ comes under the central part of the latch *u* and lifts it out of the catch *x*. A plate *e* is secured to the inside of the door to the elevator-shaft opposite the plate of the inside door. A latch V, shaped like the two sides of a triangle, is pivotally secured at the point *w* to said plate and is adapted to secure the door by connection with the catch *x*′. Above the pivot of the latch a slot W is cut in the latch, and a spring W′, secured to the plate *e*, operates in the slot, pressing the upper part of the latch downward upon the catch. Secured to the plate of the door E and extending vertically parallel to the lower part of the latch V is a bar V′. There is sufficient space between the latch V and the bar V′ for the square part of the bolt *s* to pass. When it is not desired to stop the elevator on a certain floor, the door of the cage being closed, the bolt *s* passes between the latch V and the bar V′ without disturbing the latch; but when the elevator is stopped and it is desired to open both doors the lever-latch T is lifted, which turns over the bolt *s* and brings the lug *u* in contact with the lower part of the latch V, thus lifting the latch clear of the catch. Springs X X, secured to the plate *e*, operate in the slots V″ of the bar V′ and regulate the distance between the latch and bar and the pressure against the bolt *s*. The inside corners of the bar V′ are rounded, which permits the bolt *s* to pass without undue friction. The rounded corners of the square part of the bolt permit it to turn freely between the latch and the bar V′.

My invention is intended to be used and operated as follows: As indicated in Fig. 1 of the drawings, the doors of the cage and of the shaft are closed, and the cage can pass freely in either direction. The dotted lines indicate the positions of the different parts of my invention when the doors are unlatched and the elevator is locked in its position. When the elevator stops to receive or discharge passengers or freight at a certain floor, the latch-lever T is turned over, as indicated in Fig. 1, the lug *n*′ comes in contact with the latch U, lifting it out of the catch, and the lug *u* is turned against the lower part of the latch V on the outside door, thus lifting the latch. As the door of the cage is pushed back the bolt *s*, pressing against the bar V′, pushes the door of the shaft back at the same time. The lifting and turning of the latch-lever raises the rod S, which, operating in turn on the levers R and P, pushes back the sliding bar J, so that the upper part of the bolt O enters the straight part of the bar *j*, thus pushing the bolt M into the opening I and the lower end of the bolt O into the slot *a*. The elevator cannot then be moved until both doors are closed and latched. The sliding of the

doors does not affect the locking of the elevator in its position, as it is locked by the lifting of the latch before the doors are opened and is not unlocked until the latches are again secured.

It will be seen that with my invention it is impossible to move the elevator while either of the doors is open or unsecured, and one of the most fruitful sources of accidents is thus removed.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A bar secured to the door of an elevator-cage and capable of a limited lateral movement, said bar having a vertical slot cut longitudinally therethrough and diverging at one end, a bolt adapted to enter and move in said slot and bent so that one end thereof is capable of entering a slot in the wall beside the cage of the elevator, a bolt secured to said first bolt supported by suitable means and adapted to have one end engage the hand-lever of the elevator and secure said lever when said bar is moved, and a lever for moving said bar, substantially as described.

2. A door to an elevator-cage, a bar extending across the inside of said door and capable of a limited lateral movement, said bar having a vertical slot cut longitudinally therethrough and diverging at one end, a bolt having forked extensions which embrace the upper and lower surfaces of said bar and movably secured opposite the hand-lever of the elevator and the other end of said bolt adapted to engage said lever, said forked extensions embracing said bar near the end where said slot diverges, a bolt secured to the ends of said forked extensions passing through said slot and bent in such manner that the end thereof is capable of entering a slot in the wall beside the elevator, and a lever for moving said bar upon the door, substantially as described.

3. A door to an elevator-cage having a latch securing the same, a latch-lever pivotally secured to said door having a lug capable of raising said latch when said lever is turned, a bolt secured at one end to said latch-lever and extending through and beyond said door, a lug near the outer end of said bolt, in combination with the door to the elevator-shaft, a triangular-shaped latch pivotally secured to said shaft-door, securing the same when the door is closed, a bar secured to said door parallel with the vertical part of said latch, and at a sufficient distance from said latch to permit the said bolt to pass between, substantially as described.

4. A movable bar extending across the inside of a door to an elevator-cage, said bar having a vertical slot cut longitudinally therethrough and diverging outwardly at the end near the hand-lever of the elevator, a bolt operating in the slot of said bar, one end of which is adapted to engage and lock the hand-lever of the elevator when said lever is in a vertical position, a second bolt connected with said first bolt and adapted to enter the wall at the same time and secure the elevator in its position, a lever pivotally secured at one end to said movable bar and at the other end pivotally connected with the latch for securing the door, said lever being adapted when the latch is raised to pull said movable bar into such position that the said first bolt is in the straight part of said slot and is thereby thrown into connection with said hand-lever securing the same, substantially as described.

5. A door to an elevator-cage, a bar movably secured to said door and having a vertical slot cut longitudinally through said bar, said slot diverging outwardly at the end opposite the hand-lever of the elevator, a bolt having forked extensions embracing the upper and lower surfaces of said bar and movably secured opposite said hand-lever, the other end of said bolt being adapted to engage said lever, a bolt secured to the ends of said forked extensions passing through said slot and adapted to have one end engage a slot in the wall beside the elevator a lever pivotally connected at one end to said bar and having pivotal connection at the other end with the latch-lever of said door, a latch-lever pivotally secured to said door and adapted to raise the latch of said door and to move said bar having said slot, a bolt secured to said latch-lever and extending through and beyond said door, said bolt having a lug near the outer end thereof extending at a right angle to said bolt, in combination with the door to the elevator-shaft, a triangular-shaped latch pivotally attached to said door and adapted to secure the same, a bar secured to said door parallel with the free part of said latch and at a sufficient distance from said latch to permit said bolt to pass between, substantially as described.

6. A door to an elevator-cage adapted to slide on suitable rollers, a bar J extending across the lower part of said door and adapted to be moved laterally on said door, said bar having a vertical slot cut longitudinally therethrough and diverging toward said door at the rear end thereof, an arc-shaped bar G′ secured to the hand-lever of said elevator a short distance above the elevator-floor, said bar having an opening in the part secured to said lever, a bolt M having forked extensions N, N, movably supported opposite said bar by suitable means and adapted to engage the opening in said bar G′, the forked extensions N, N embracing said bar J, a bolt O secured to the ends of said forked extensions passing through said slot *j*, and bent so as to engage a slot in the wall beside said elevator, suitable means for movably supporting said bolt, a lever P pivotally secured at one end to said bar J and at the other end to a triangular-shaped lever R, a lever R pivotally secured near the center to said door, the other end of said lever being pivotally secured to a lever S, said lever S being pivotally secured to a latch-lever T, a latch-lever T piv-

otally secured to said door, having a round central part and an extension *l* with handle *v*, and an extension *n* with lug *n'* adapted to lift the latch when the lever is turned, a bolt *s* secured to the round central part of said latch-lever and extending through and beyond said door, said bolt *s* having a lug *u* near the outer end of said bolt extending at a right angle to said bolt and in the opposite direction from said extension *l*, in combination with a door to the elevator-shaft, a triangular-shaped latch V adapted to secure said door by connection with the catch *x'*, said latch being pivotally secured to said door, a bar V' secured to said door parallel with the vertical part of said latch, and at a sufficient distance therefrom to permit said bolt *s* to pass between, and means for regulating the distance between said latch and bar, substantially as described.

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

FREDERICK HEIZER.

Witnesses:
F. W. LOHR,
H. C. GARDINER.

No. 705,479. Patented July 22, 1902.

S. D. STROHM.

SAFETY DEVICE FOR ELEVATORS.

(Application filed Apr. 4, 1896.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1

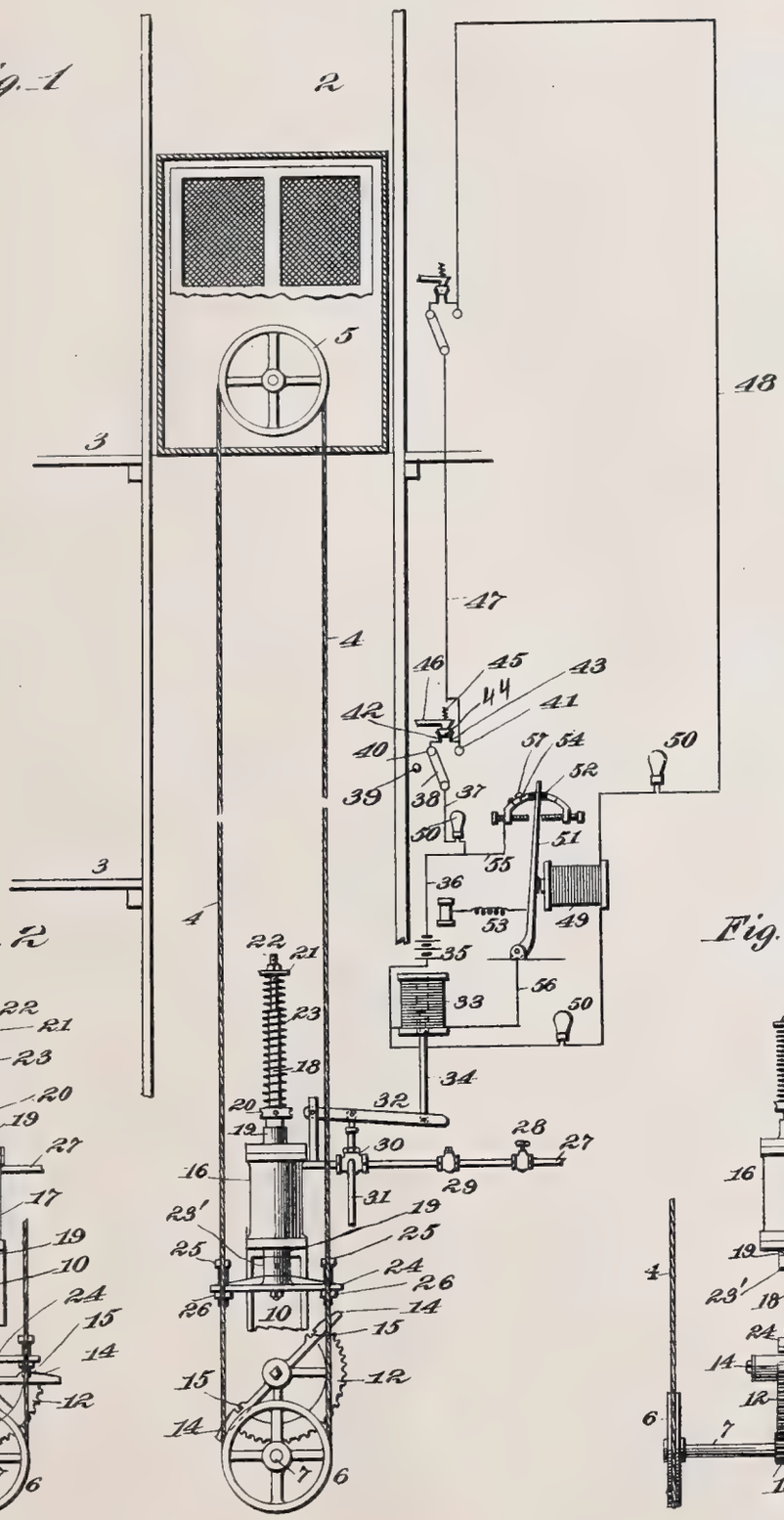


Fig. 2

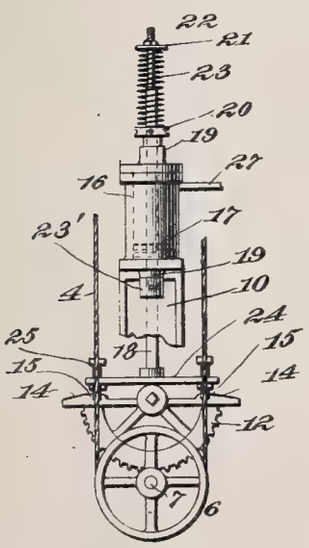
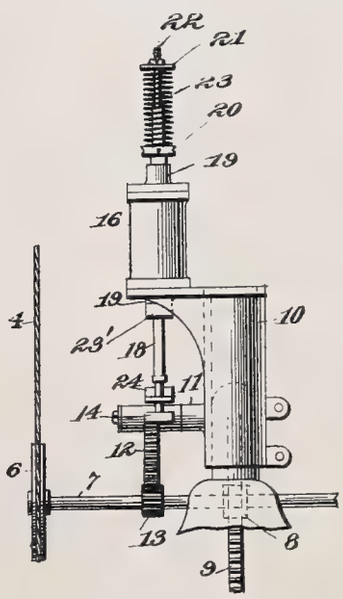


Fig. 3



Witnesses.

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Frank L. Ayer

Inventor
Samuel D. Strohm

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Att'y.

No. 705,479. Patented July 22, 1902.

S. D. STROHM.

SAFETY DEVICE FOR ELEVATORS.

(Application filed Apr. 4, 1896.)

(No Model.) 5 Sheets—Sheet 2.

Fig. 5

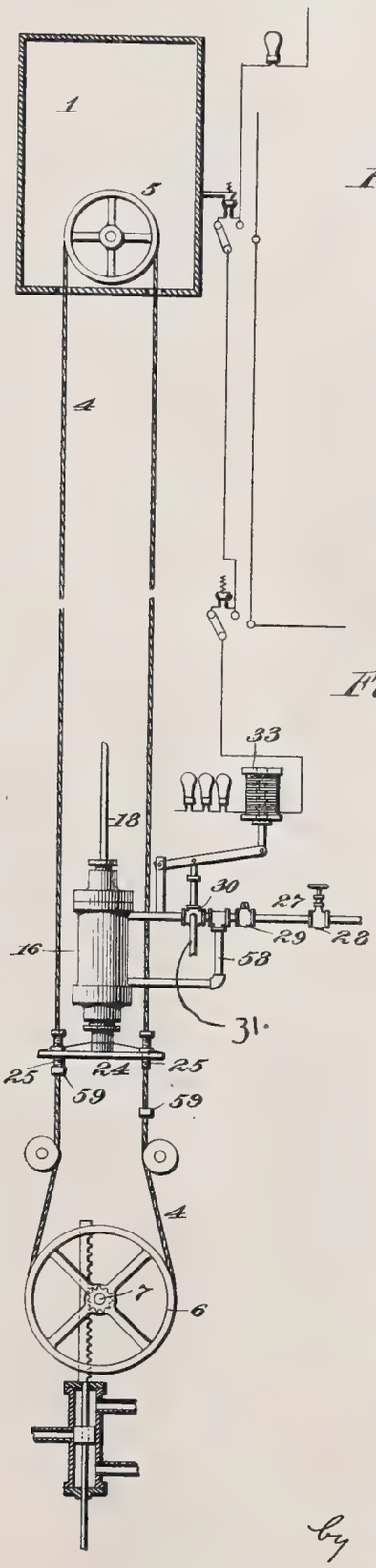


Fig. 6

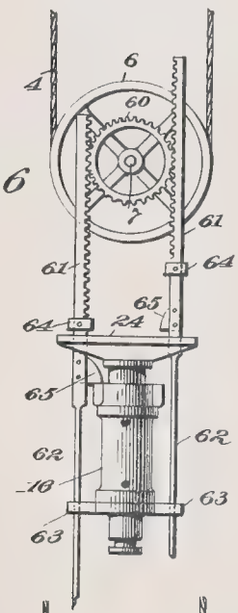


Fig. 4

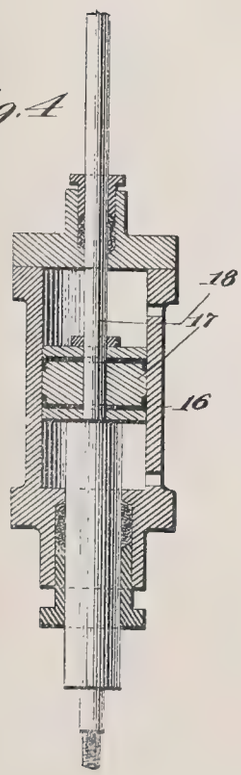
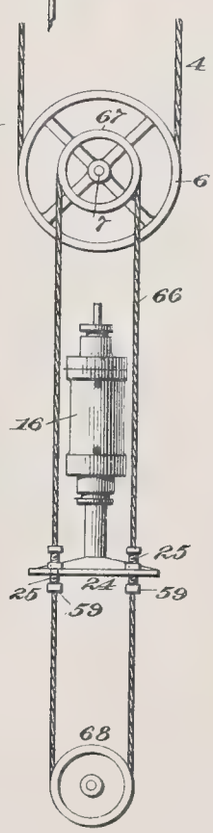


Fig. 7



Witnesses.

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No. 705,479. Patented July 22, 1902.

S. D. STROHM.

SAFETY DEVICE FOR ELEVATORS.

(Application filed Apr. 4, 1896.)

(No Model.) 5 Sheets—Sheet 3.

Fig. 8

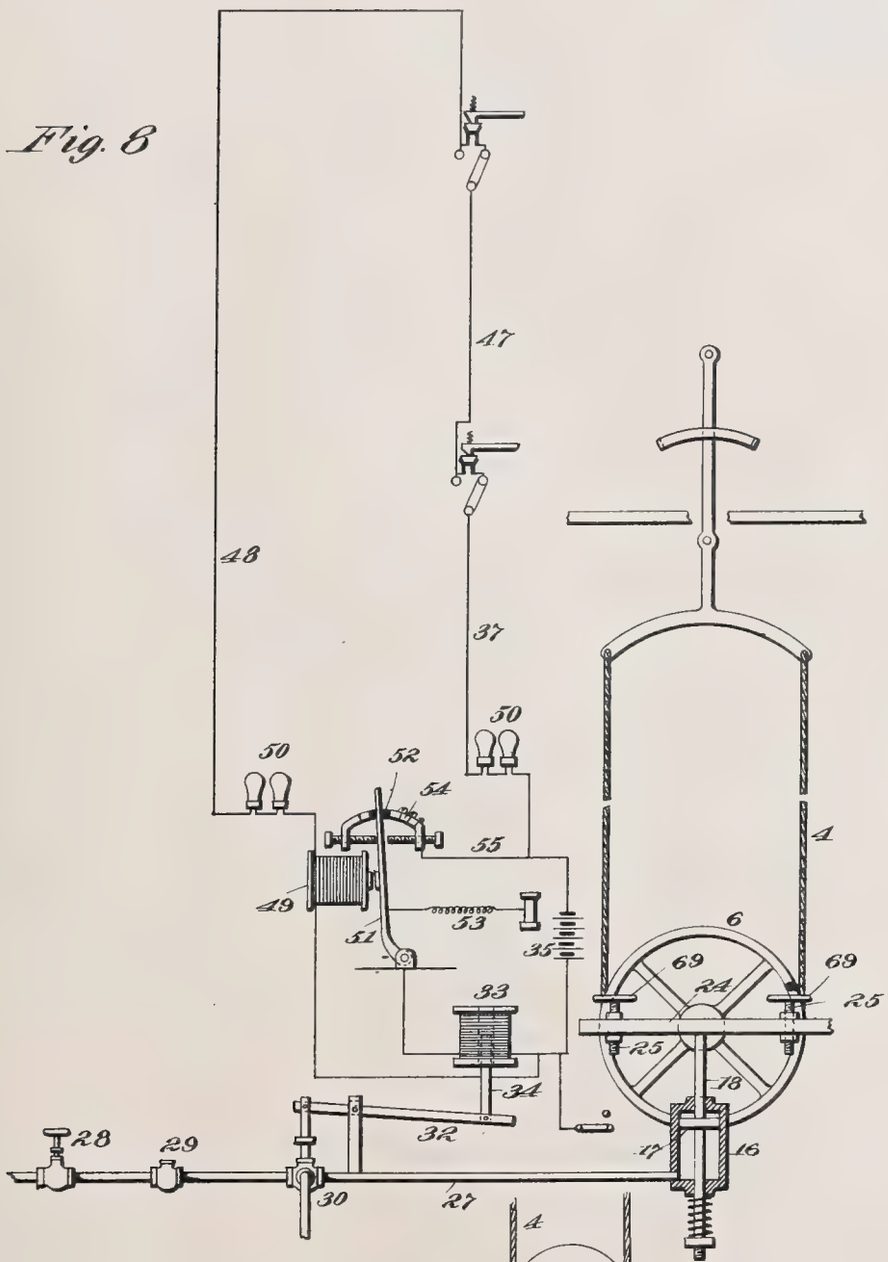
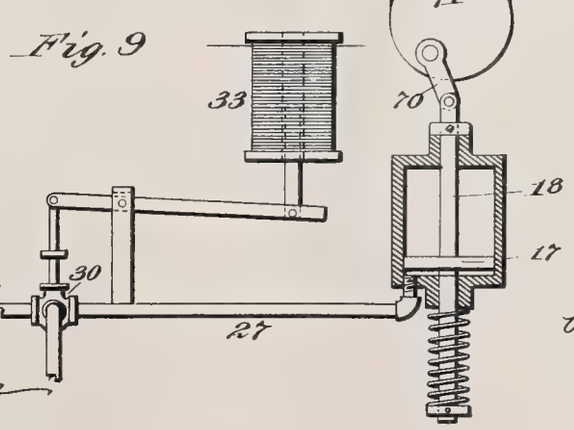


Fig. 9



Witnesses.

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by R. A. Morison
Atty.

No. 705,479. Patented July 22, 1902.

S. D. STROHM.

SAFETY DEVICE FOR ELEVATORS.

(Application filed Apr. 4, 1896.)

(No Model.) 5 Sheets—Sheet 4.

Fig. 10

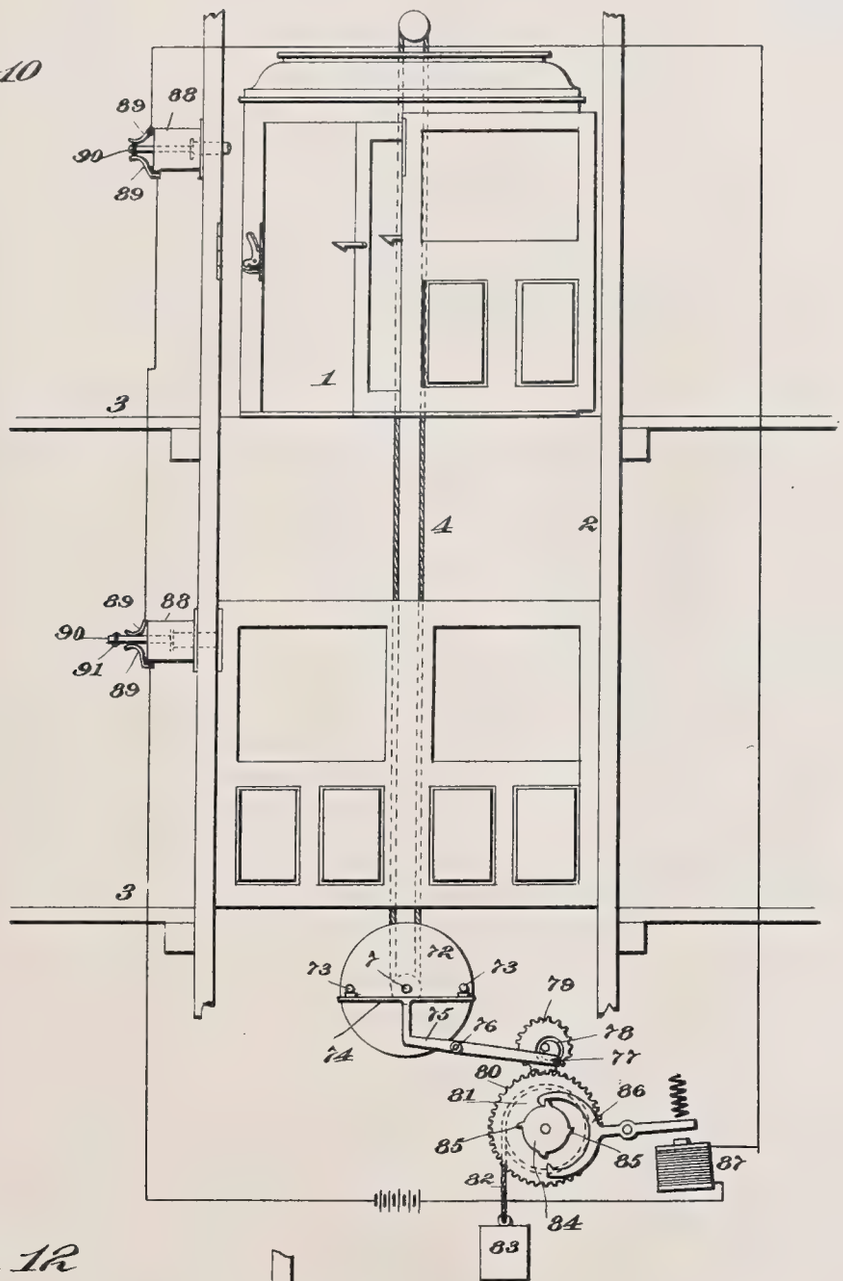
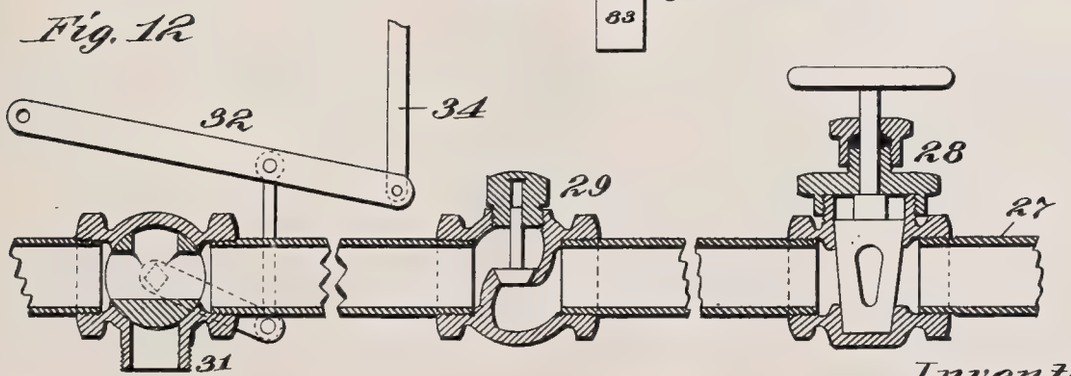


Fig. 12



Witnesses.

J. F. Coleman

Frank L. Ayer

Inventor

Samuel D. Strohm

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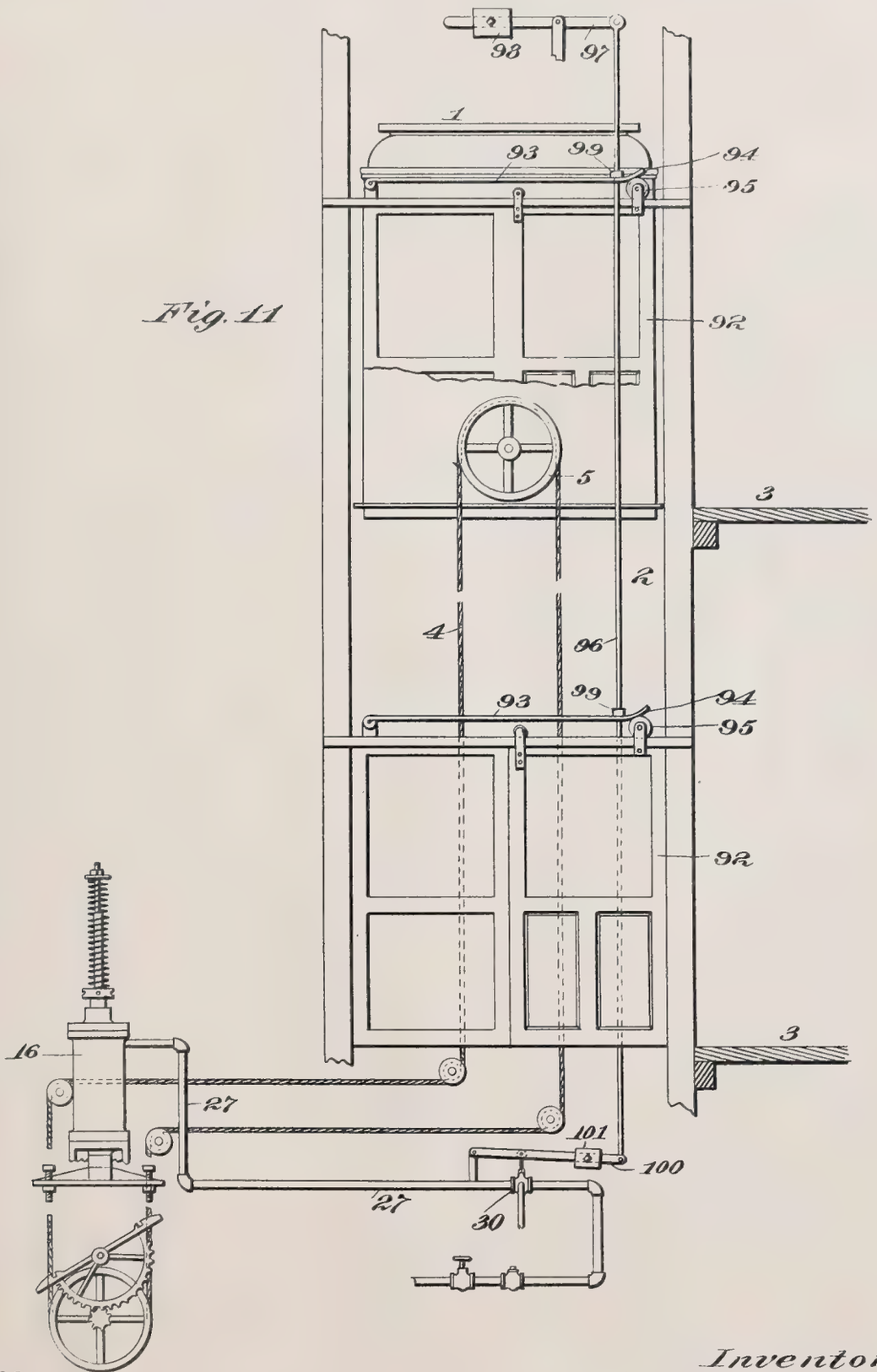
Fig. 11



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UNITED STATES PATENT OFFICE.

SAMUEL D. STROHM, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO STROHM ELEVATOR SAFETY DEVICE COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF NEW JERSEY.

SAFETY DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 705,479, dated July 22, 1902.

Application filed April 4, 1896. Serial No. 586,212. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL D. STROHM, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Safety Devices for Elevators, (Case B;) and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to various new and useful improvements in safety devices for elevators, which improvements are designed more particularly for use with passenger-elevators.

The object of the invention is to provide a device or devices capable of attachment to and employment with any type of elevator operated by any power and by means of which absolute safety in operation will be assured. To effect that end I provide electrically or mechanically operated or controlled mechanism, whereby whenever any one or more of the landing-doors (or, if desired, the car-door also) is in an unsafe or insecure condition it will be impossible to start the car and which may be so arranged that the car, if in motion, will be instantly stopped whenever any of said doors is opened or otherwise rendered unsafe or insecure.

With my present invention, therefore, it will be necessary to entirely close the door at the landing where the car is stopped before it can again be put in motion, and it will be impossible also to operate the car when any landing-door has been opened, whereby two very fruitful sources of danger now recognized in the operation of passenger-elevators are overcome.

Instead of employing the safety device in connection with the landing-doors the same may be used with the car-door only, in which case it will be necessary to close the same before the car can be started and by means of which the car will be stopped if the door thereof is opened, whereby another source of danger is overcome.

Preferably I arrange my safety device in such a way that it will be necessary not only to close but also to secure the landing or car door before the car can be put in motion, in which case the electrically or mechanically controlled mechanism will operate in connection with the latch, bolt, lock, or other securing device for the door; but the said device may be so arranged that the closing or shutting of the door alone will render operative the actuating mechanism of the elevator, all as I will fully hereinafter describe and claim.

In order that my invention may be better understood, attention is directed to the accompanying figures, forming a part of this specification, and in which—

Figure 1 is a diagrammatic view of a well-known form of hydraulic elevator with the operating mechanism removed, showing the preferred arrangement of my improved safety devices and illustrating the parts in their active position; Fig. 2, a front elevation of the valve-controlling mechanism thereof, showing the parts in their inactive position; Fig. 3, a side elevation of the same; Fig. 4, a sectional view of the modified arrangement of controlling-cylinder; Figs. 5, 6, 7, 8, 9, 10, and 11, views of modified forms of devices which will be described in detail; and Fig. 12, an enlarged view of the pipe 27 and valves therein, to be presently described.

In all of the above views corresponding parts are represented by the same reference-numerals.

Referring particularly to the preferred form of apparatus shown in Figs. 1, 2, and 3, 1 represents an elevator car or cage, movable in a shaft 2 past the several landings 3 3 in the ordinary way. 4 is a controlling-rope, operated in this instance by a hand-wheel 5 in the car and passing around the periphery of a pulley 6, keyed to a shaft 7. 8 is a pinion mounted on said shaft, engaging with a rack 9, which rack is connected to the valve of the hydraulic cylinder and controls said valve in any suitable way. The parts described are of well-known construction, and I make no claim to the same. In an apparatus of this kind the parts are so adjusted that when the hand-wheel 5 occupies a central position the valve will be centered and the water will

be locked in the main controlling-cylinder, and as said hand-wheel is moved to one side or the other said controlling-cylinder will be put in connection with the pressure or discharge ports of the valve-chest, so as to raise or lower the car. My improved safety devices are used in connection with an elevator of this or any other suitable construction in such a way that absolute safety of operation will be obtained, as will be explained. In the preferable form of apparatus shown in these three views I carry upon the main valve-chest a suitable supporting-bracket 10, having a bearing 11, formed at one side thereof. Mounted upon said bearing 11 is a semicircular rack 12, engaging with a pinion 13, keyed to a shaft 7. The rack 12 carries at its upper end two cam-plates 14, having centering-recesses 15 15 therein.

16 is a cylinder carried on the bracket 10 and having a piston 17 therein. The piston-rod 18 extends through stuffing-boxes 19 19 at the top and bottom of said cylinder and projects some distance above the cylinder, as shown.

20 is the cap-plate of the upper stuffing-box, and 21 is an adjusting-plate engaging with screw-threads at the upper part of the piston-rod, whereby the position of said plate 21 may be adjusted vertically thereon. Between the plates 20 and 21 is a coiled spring 23, the tension of which tends to keep the piston 17 normally elevated in the cylinder 16.

In order to limit the movement of the piston 17, I preferably mount on the piston-rod thereof a collar 23′ of the proper length and which comes in contact with the lower stuffing-box when the piston is in its uppermost position, and thereby determines that position.

24 is a cross-head carried at the lower end of the piston-rod 18 and having adjusting-screws 25 25 at the ends thereof. The position of these screws 25 in said cross-head may be readily adjusted, and said screws may be held securely in any position by means of lock-nuts 26.

By employing the adjusting-screws 25 the relation between the cross-head 24 when at its lowermost position and the cam-plates 14 can be very accurately regulated, and hence the closing of the controlling-valve be effected with the greatest nicety. This is of importance, because by reason of the packing of the valve wearing away in use provision must be made for the adjustment of the parts.

27 is a supply-pipe preferably connected with the actuating-pump, which pipe leads into the cylinder 16 at the upper end thereof. If desired, the said supply-pipe may be connected to an air-chamber in which compressed air is stored or it may receive any other fluid or gas under pressure. This pipe is provided with a supply-valve 28 therein, with a check-valve 29, and with a three-way valve 30, said three-way valve normally connecting the interior of the cylinder 16 with the discharge-pipe 31, but is arranged when moved to cut out the discharge-pipe and to connect said cylinder with the pressure-supply. The stem of the valve 30 connects with a lever 32, which is adapted to be operated by a solenoid 33 or any other suitable device. When a solenoid is used, the core 34 thereof may be connected directly with the said lever 32. Said solenoid or other controlling device is adapted to be under the control of circuit breakers or closers adjacent either to the landing-doors or to the elevator-car door, or to both, and adapted to be operated when any one or all of said doors is or are in an unsafe or insecure condition.

In Fig. 1 I illustrate diagrammatically means whereby it is necessary not only to close the landing-doors before the parts are put in their operative position, but to actually secure the same; but I am not to be limited to the same, since other means may be used, operated in other ways, such as by the mere closing of the doors.

35 is a suitable source of electric supply, which may be either a battery or the supply-mains of a building. A wire 36 leads from one side of the supply to a branch 37, thence to a switch-arm 38 on the first landing, which switch-arm is preferably concealed and may be operated by a key or in any other suitable way. Said switch-arm is adapted to make contact with the contact-plates 39, 40, and 41. The contact-plate 39 may be grounded or be a dead plate, so as to cut out the circuits when desired. The plate 40 is connected to a contact-spring 42, carried adjacent to the lock of the door. 43 is another contact-spring adjacent thereto, and 44 is a contact-plate held normally out of engagement with said contact-springs by a spring 45, but adapted to be forced into contact with said contact-springs by the keeper or latch 46 of the door when the same is secured, so as to complete the circuit between the contact-plates 42 and 43. The plate 41 is connected to the contact-spring 43, so that the switch-arm 38 may be moved upon said plate 41 to cut out the circuit-breaker at any of the landings when any one of the circuit-breakers is disabled. From the contact-spring 43 a wire 47 extends to the floor above and through a similar circuit-closing device and thence in series throughout all the floors of the building. From the circuit-closer on the top floor a wire 48 returns through a relay-magnet 49 to the other side of the source of current-supply. If desired, resistances 50 50 may be interposed in the circuit above described.

The arm 51 of the relay is normally held on the insulated section 52 by the attraction of the magnet 49, since the primary circuit of the relay in this instance is normally closed; but when said circuit is broken, as by the unlatching or unfastening of any one or more of the landing-doors or car-doors, said lever 51 is retracted by the spring 53 onto a plate 54. Said plate 54 connects by a wire 55 with

the wire 36, so that the secondary circuit of the relay will then be from the source of supply through wires 36 and 55 to the plate 54, through relay-lever 51, wire 56, and through solenoid 33 to the other side of the current-supply. If desired, resistances 57 may be interposed between the plate 54 and the source of supply, so as to prevent sparking.

The operation of the device just described will be readily understood, and is as follows: When all the landing-doors, and also the car-door, if equipped, are closed, the primary circuit of the relay will be closed, energizing the relay-magnet 49 and breaking the secondary circuit through the solenoid 33. In this condition the valve 30 will be closed and the spring 23 will have forced the piston 17 to its uppermost position, whereby the valve-rope 4 may be operated to move the elevator-valve in any direction. If, however, one of the elevator-doors is opened or unlatched or otherwise placed in an unsafe or insecure condition, the primary circuit of the relay will be broken, whereby the magnet thereof will be deënergized. In this case the lever 51 will be retracted by the spring 53 and the current from the source of supply will pass immediately through the solenoid 33, so as to energize the same, elevating the lever 32 and opening the valve 30. The fluid under pressure will then pass from the pipe 27 into the upper end of the cylinder 16, forcing the piston 17 therein downward and causing the adjusting-screws on the cross-head 24 to engage with one or the other of the cam-plates 14, according to which is in the elevated position, so as to throw the rack 12 to its horizontal position, at which time said adjusting-screws 25 will engage in the recesses 15, as shown in Fig. 2. When in this position, the elevator-valve will be closed, so that movement of the car will be arrested. By employing the recesses 15, in which the adjusting-screws will engage when the piston is operated, the parts will be locked very securely together, so as to effectively prevent the possibility of the valve being opened from the car even when the utmost efforts are made to operate the same. This locking of the valve will occur whenever any one of the landing-doors is in an unsafe or insecure condition, and when the elevator is at a landing and the door thereof is open it will be impossible to start the hand-wheel 5 against the pressure in the cylinder 16. To further lock the cross-head 24 in its lowered position, the check-valve 29 is employed, which operates as a positive check to any movements of the piston 17 when the valve 30 is opened. When, however, the landing-door which has been opened is closed, so as to close the safety-circuit through the relay-magnet and to energize the same, the lever-arm 51 will be attracted thereby and moved onto the insulated section 52, so as to break the secondary circuit, deënergize the solenoid 33, and allow the valve to close putting the cylinder 16 into communication with a discharge-pipe 31. The spring 32 will then return the parts to their former position, so that the elevator-rope will be free to move.

The main features and general principles of my invention being understood from the above description, the operation of the various modified forms illustrated will be readily comprehended.

In Figs. 4 and 5 I illustrate an improved form of controlling-cylinder 16, wherein the spring 23 may be dispensed with. In this form of device the piston-rod 18 below the piston 17 is of a much larger area, so that the operative area of the bottom of the piston will be much less than that of the top thereof. Connecting the pipe 27 behind the valve 30 with the lower end of the piston 16 is a pipe 58. By means of this construction pressure will always be exerted beneath the piston 17, so as to normally keep the same elevated; but when the valve 30 is open and pressure is allowed to enter the upper part of the cylinder the greater area of the top of the piston 17 will overbalance the same and force the cross-head 24 downward. In the form shown in Fig. 5 I dispense with the semicircular rack 15 and its connecting elements and instead secure upon the valve-rope 4 two stops 59 59, with which the adjusting-screws 25 on the cross-head 24 come into engagement when the piston 17 is forced downward, so that said stops will be brought to a horizontal position to close the elevator-valve. In this figure also I dispense with the relay and maintain the solenoid 33 in a constantly-closed circuit which extends through the circuit-breakers at the several landings. In this modification, therefore, the valve 30 is reversed, so that when it is in its elevated position the discharge-pipe 31 will be in communication with the top of the cylinder. When the circuit of the solenoid 33 is broken, said valve will move downward, so as to put the upper part of the cylinder into communication with the pipe 27, as explained.

In Fig. 6 I illustrate a further modification which possesses some features of advantage in special connections. 60 is a gear-wheel mounted on the shaft 7 adjacent to the pulley 6. Engaging with said gear-wheel 60 at each side thereof is a rack 61, said racks having guide-rods 62 at their lower ends working in bearings 63 at the lower end of the cylinder 16. 64 represents stops secured to the racks 61 and with which the cross-head 24, carried on the piston-rod of the cylinder 16, engages, so as to bring said stops 64 in line with each other and close the elevator-valve. In this construction of apparatus I also make use of a lug 65, secured to each rack 64 and adapted to engage with the upper end of the cylinder 16, so as to limit the movement of the parts and prevent the elevator-valve from being opened too far.

In the modified form of figure shown in Fig. 7 an arrangement very similar to that

shown in Fig. 5 is employed, except that the stops 59 instead of being secured directly to the valve-rope 4 are secured to a rope 66, which passes around a pulley 67, keyed to the shaft 7, and around an idler 68. It is to be observed that instead of employing ropes for this purpose sprocket-chains may be used, if desired.

Instead of any of the arrangements illustrated the form of device shown in Fig. 8 may be used, which possesses for some cases and under some conditions great superiority, since it is simple and extremely sensitive. In this form of device I mount directly upon the pulley-wheel 6 two stops 69, with which the adjusting-screws 25 of the cross-head 24 are adapted to engage when the piston 17 is operated, so as to bring said stops in line with each other and close the elevator-valve.

In the form of apparatus shown in Fig. 9 I connect the piston-rod 18 by means of a connecting-rod 70 with a disk wheel or similar element 71, to which the valve-rope is connected and which operates the elevator-valve either directly or indirectly. In the position of the parts illustrated the valve is entirely opened to run the car up or down. When the valve 30 is opened, the piston 17 is forced upward, partially rotating the disk 71 and closing the valve, as will be understood.

In all of the forms of my improved devices which have been described above I have illustrated the employment of a cylinder having a piston therein adapted to be moved when a valve is opened, said valve being controlled by an electric device energized or deenergized by the making or breaking of a supply-circuit at any one of the landings. My invention is, however, broader than this and is capable of being carried out in other ways than by the employment of a cylinder, such as will suggest themselves to persons skilled in the art, and in Fig. 10 I illustrate means whereby this may be done. In this form of device I secure a face-wheel 72 on the shaft 7 and provide the said face-wheel with two pins or studs 73, which when brought in line with each other maintain the elevator-valve in its closed position. 74 is a cross-head carried on a lever 75, fulcrumed at 76 and having a pin 77 at its free end. This pin works within a cam-groove 78 in the face of a gear-wheel 79, said gear-wheel meshing with a larger gear-wheel 80, secured to a drum 81, around which a rope 82 is wound, to the lower end of which is attached a weight 83, whereby said drum 81 tends to revolve. Secured to the shaft of said drum is an escapement-wheel 84, having in this instance four teeth 85, and engaging with said escapement-wheel is an escapement 86, controlled by a magnet or magnets 87. In the arrangement of parts shown in this figure the gear-wheel 80 is of twice the diameter of the gear-wheel 79. Instead of providing a circuit-breaker controlled by a latch or bolt of the doors, as I have before described, I illustrate in this figure a circuit-breaker adapted to be operated by the opening and closing of the landing-doors. Said circuit-breaker in this instance consists of an insulated block 88, having contact-springs 89 89 thereon and provided with a metallic plunger 90, which projects into the door-casing and which is adapted to be normally forced back by the closing of the door. Said plunger is provided with an insulated stud 91 thereon, which when the door is opened is brought between the contact-springs 89 89, so as to break the circuit at that point. In order that this may be done, the said plunger 90 is provided with a spring thereon, which normally tends to move the same in the direction of the door when the door opens. In this form of device the circuit is normally closed throughout the circuit-closers at the landing, and the escapement 86 engages with one of the teeth 85. The parts are so adjusted that in this position the cross-head 74 will be retracted from the studs 73, so that the valve-rope 4 may be freely moved to control the elevator-valve. When, however, the circuit to the magnet or magnets 87 is broken at one of the landings, the said magnet or magnets is or are deënergized, disengaging the escapement 86 from the tooth with which it was in engagement and allowing the drum 81 to revolve one-fourth of a revolution, carrying the gear-wheel 79 through half of a revolution and by reason of the cam-groove 76 therein elevating the cross-head 74, so as to bring the studs 73 in line with each other and close the elevator-valve.

Instead of carrying out the general principles of my invention by means of electrical appliances operating in connection with the landing-doors or car-door, as I have explained, it is possible to employ for that purpose mechanical devices operating in an analogous way and which in some instances may be of importance, as by their use the necessity of attending to batteries and the care required to effect the proper insulation and connection of the parts are overcome.

In Fig. 11 I illustrate a convenient form of mechanism showing how the same principles may be carried out in a perfectly practical way by mechanical devices operating in connection with the landing-doors. In this figure, 92 92 represent landing-doors on an elevator-shaft, in which a car 1 travels. Above each landing-door is pivoted a lever 93, having a curved forward end 94. Engaging beneath each lever is a roller 95, carried on each of the landing-doors and so arranged that as any one of the landing-doors is opened the said roller will engage with the lever 93 and elevate the same. 96 is a controlling rope or rod counterbalanced at its upper end by means of a lever 97 and weight 98, said controlling-rope being provided with nuts or other stop devices 99 thereon, with which the levers 93 engage. Preferably said nuts or other stop devices are adjustably secured to the

rod 96, so that their position thereon may be properly adjusted. The rod 96 connects at its lower end with a lever 100, normally held in its lowered position by means of a weight 101, said lever being connected with the valve 30, so as to operate the same. In order to illustrate the capabilities of my invention, I show in this figure controlling mechanism of the operating-engine to one side of the elevator-shaft, which is frequently necessary in actual use. In this instance, therefore, the cylinder 16 connects with a pipe 27, which may be of any length, while at the same time the controlling-valve 30 thereof may be located immediately beneath the elevator, so that the controlling rod or rope 96 may be made without any joints or wearing parts. The advantage of this construction will be obvious, because if the valve 30 were located adjacent to the cylinder 16 it would be necessary to employ intermediate connections between said rod 96 and said valve, in which there would be always lost motion and friction, and there would be great danger of the same becoming broken. In operation it will be noted that when the landing-doors are all closed the controlling rope or rod 96 will be at its lowermost position, so as to close the valve 30 and put the cylinder 16 into communication with the overflow-pipe, the parts being thereby in the positions shown in the figure. When, however, any one of the landing-doors is opened, the roller 95 thereof engaging the valve, the lever 93 will elevate the latter, so as to raise the controlling-rod 96 upon the valve 30 and allow water or other fluid under pressure to enter the cylinder 16 and force the cross-head thereof downward, so as to center and thereby close the valve.

In Figs. 1, 5, 8, and 11 I show the controlling-rope 4 as being movable with the car, in which case it is combined with any of the ordinary compensating devices for maintaining the rope under the requisite tension, and in Fig. 10 the valve-rope is stationary and the car moves in respect to the same, as also is usual. Since the invention does not relate to the mechanism for actuating the valve or other controlling mechanism, I have illustrated the controlling-rope conventionally.

Before claiming my invention I desire to have it understood that many changes may be made therein without departing from the spirit thereof, both mechanically and electrically, and that any suitable kinds of electric breaking and closing devices may be employed and that the invention may be successfully carried out with an open circuit as well as with a closed circuit, in which case it will be noted that instead of arranging the circuit-breakers in series, as shown in the figures, the said circuit-breakers will be arranged in multiple arc, as will be understood.

Having now described my invention, what I claim as new therein, and desire to secure by Letters Patent, is as follows:

1. The combination of an elevator-car and a door, with means for locking said car by fluid-pressure when said door is open.

2. The combination of an elevator-car and a door with means for controlling the power-operating mechanism of said car by fluid-pressure by the opening and closing of said door.

3. A safety device for elevators, comprising a cylinder and a piston therein connecting with the elevator-controlling mechanism, so as to be adapted to move the latter to an inactive position, a valve for said cylinder, and connections between said valve, and a door adjacent to the elevator-shaft, whereby when said door is put in an unsafe or insecure condition, the said valve will be operated, substantially as set forth.

4. A safety device for elevators, comprising a cylinder, a piston therein, a cross-head connected with said piston normally retracted from the elevator-controlling mechanism, but adapted to engage and force the same to an inactive position, a valve for said cylinder, and connections between said valve, and a door adjacent to the elevator-shaft, whereby when said door is put in an unsafe or insecure condition, the valve will be operated, substantially as set forth.

5. A safety device for elevators, comprising a pulley connected with and operating the elevator-valve, a controlling-rope connected to said pulley, two stop-plates connected with said pulley adapted to be brought to a horizontal position so as to turn said pulley to close the elevator-valve, a cylinder mounted above said stop-plates, a piston in said cylinder, a cross-head connected with said piston, normally disengaged from said stop-plates, but adapted to engage the same, a valve for said cylinder, and connections between said valve, and a door opening upon the elevator-shaft, substantially as set forth.

6. In a safety device for elevators, the combination of a pulley 6 connected to and operating the elevator-valve, a controlling-rope for said pulley, a pinion 13 on the pulley-shaft, a semicircular rack 12 engaging with said pinion, cam-plates 14, 14, secured to said rack, a cylinder 16, a piston 17 in said cylinder, a cross-head 24 connected to said piston, adjusting-screws 25, 25, on said cross-head, adapted to engage with said cam-plates 14, a valve 30 for said cylinder, and connections between said valve, and a door opening upon the elevator-shaft, substantially as set forth.

7. In a safety device for elevators, the combination of a pulley 6 connected to and operating the elevator-valve, a controlling-rope for said pulley, a pinion 13 on the pulley-shaft, a semicircular rack 12 engaging with said pinion, cam-plates 14, 14, carried by said semicircular rack, each cam-plate having a recess 15, a cylinder 16, a piston in said cylinder, a cross-head 24 connected to said piston, adjusting-screws 25, 25, on said cross-head, normally disengaged from said cam-plates, but adapted to engage the same, a

valve 30 for said cylinder, and connections between said valve, and a door opening upon the elevator-shaft, substantially as set forth.

8. In a safety device for elevators, the combination of a pulley 6 connected to and operating the elevator-valve, a controlling-rope for said pulley, a pinion 13 on the pulley-shaft, a semicircular rack 12 engaging with said pinion, cam-plates 14 carried by said rack, a cylinder 16, a piston in said cylinder, a cross-head 24 carried by said piston, but adapted to engage said cam-plates 14, a spring 23 normally keeping said piston in one position of its travel, a valve 30 for said cylinder, and connections between said valve, and a door opening upon the elevator-shaft, substantially as set forth.

This specification signed and witnessed this 12th day of March, 1896.

SAMUEL D. STROHM.

Witnesses:
FRANK L. DYER,
L. DELLA MCGIRR.

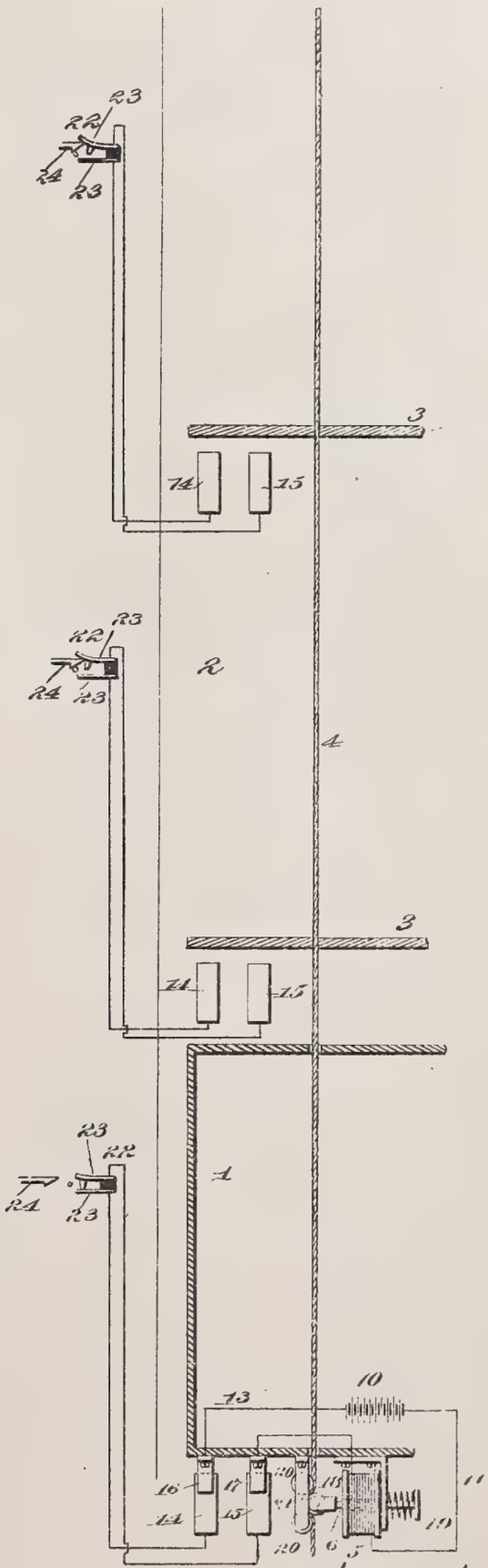
No. 705,480. Patented July 22, 1902.

S. D. STROHM.

SAFETY DEVICE FOR ELEVATORS.

Application filed Apr. 4, 1896.)

(No Model.)



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UNITED STATES PATENT OFFICE.

SAMUEL D. STROHM, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO STROHM ELEVATOR SAFETY DEVICE COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF NEW JERSEY.

SAFETY DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 705,480, dated July 22, 1902.

Application filed April 4, 1896. Serial No. 586,214. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL D. STROHM, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Safety Devices for Elevators, (Case D;) and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to various new and useful improvements in safety devices for elevators, designed particularly for use as passenger-elevators, the invention being adapted for ready application to any elevators controlled by an actuating-rope or by equivalent devices.

The object of the invention is to provide an attachment to elevators whereby absolute safety of operation will be assured.

By means of the invention where an elevator-car has been stopped at any one of the landings of a building it will be impossible to start the same until the landing-door has been closed and a door at any landing is opened, the elevator-car being in operation, its movement will be arrested when it reaches said landing.

To effect these ends, the invention consists in the combinations of elements hereinafter described and claimed.

The general principles of my invention are capable of being carried out in a multitude of ways; but in order that the same may be understood I illustrate in the accompanying drawing one convenient form of arrangement which may be carried out economically and which in action will be absolutely positive and certain.

The figure shows a diagrammatic view of a different form of locking device for the valve-rope or other controlling element and illustrating the application of the invention in a separate electric circuit at each of the floors.

Corresponding parts are represented by the same figures of reference.

I secure at the side of the elevator shaft or well 2 two contact-plates 14 and 15, with which two brushes 16 and 17, carried on the elevator-car, are adapted to make contact as the elevator moves up or down. The solenoid or magnet 5, which is shown carried beneath the elevator-car, is provided with a core 6, carrying the roller 18 at its free end. 19 is a coiled spring on said core, tending to normally retract the same. Opposing the roller 18 are two rollers 20 20, carried in a suitable supporting-frame 21 on the bottom of the elevator. The valve-rope 4 works between said rollers 18 and 20, as shown. The source of current-supply is shown as a battery 10, carried upon the elevator-car; but it will of course be understood that current may be supplied to the apparatus in any suitable way. The solenoid or magnet 5 is included in a partial circuit extending between the brushes 16 and 17, which circuit is adapted to be completed when said brushes are upon the contact-plates 14 and 15 if the circuit on the other side of said contact-plates is closed, due to the fact that the landing-door at the said landing is opened. At each landing, therefore, I provide a circuit-breaker 22, composed of two plates 23 23 and adapted to normally make contact, said plates being forced apart, so as to break contact at that point by the latch 24 on the landing-door. Said contact-plates 23 23 are in circuit with the plates 14 and 15.

It will be observed that when the landing-door is closed, so that the latch 24 operates the contacts 23 23, no current can pass through the solenoid or magnet 5, so that the roller 18 will be held withdrawn from the operating-rope 4. If, however, the elevator-car has been brought to the landing and stopped and the landing-door is opened, the circuit will be completed through the contact-plates 23 23 and the magnet or solenoid 5 will be energized so as to attract its core, forcing the valve-rope 4 between the rollers 18 and 20, as shown. When in this condition, the said valve-rope will be locked against movement, so that the elevator-car cannot be started either up or down. When, however, the landing-door is closed and secured, so as to break the circuit at the plates 23 23, the mag-

net or solenoid will be deënergized, whereby the spring 19 will retract the roller 18, so as to release the valve-rope, whereby the elevator may be started. Similarly, if the landing-door at any one of the landings is opened, whereby the circuit will be closed at the plates 23 23, then when the elevator-car in moving up or down passes the plates 14 and 15 the circuit through the solenoid or magnet will be completed, gripping the valve-rope 4, whereby the further movement up or down of the elevator-car will operate the valve thereof and arrest its movement. The operator on the elevator-car will then know that the door of the landing at which the elevator-car has been thus stopped is not closed and then can make it so.

It will of course be understood that the invention which I have thus described is capable of many changes in modifications which will occur to any one skilled in the art and which need not be alluded to in detail.

I do not wish to be limited in any way to the particular form of gripping mechanism carried on the elevator-car, to any forms of circuit breakers or closers at the landings, or, in fact, to any details of construction not necessary in the carrying out of the broad principles of the invention.

Having now described my invention, what I claim as new therein, and desire to secure by Letters Patent, is as follows:

1. In a safety device for elevators, the combination of an elevator-car, a controlling-rope for operating the controlling mechanism of said car, a clamping or locking device on the car normally out of engagement with said controlling-rope, a solenoid or magnet for operating said locking or clamping device, a partial or incomplete circuit carried on the car, a series of corridor-doors, a separate partial electric circuit for each of said doors, a closer in each of said circuits operated by the corresponding doors, and means whereby the partial circuit on the car will connect with the partial door-circuits when adjacent to the latter, substantially as described.

2. In a safety device for elevators, the combination of an elevator-car, a controlling-rope for operating the controlling mechanism of said car, a clamping or locking device on the car normally out of engagement with said controlling-rope, a solenoid or magnet for operating said locking or clamping device, a partial or incomplete circuit carried on the car, the contacts 16, 17, thereon, a series of corridor-doors, a separate partial electric circuit for each of said doors, a closer in each of said circuits operated by the corresponding doors, and the contacts 14, 15, whereby the partial circuits of the car will connect with the partial door-circuits, when adjacent to the latter, substantially as described.

This specification signed and witnessed this 12th day of March, 1896.

SAMUEL D. STROHM.

Witnesses:
FRANK L. DYER,
L. DELLA MCGIRR.

No. 707,311. Patented Aug. 19, 1902.

J. W. FLEMING.

SAFETY DEVICE FOR ELEVATORS.

(Application filed Apr. 30, 1902.)

(No Model.)

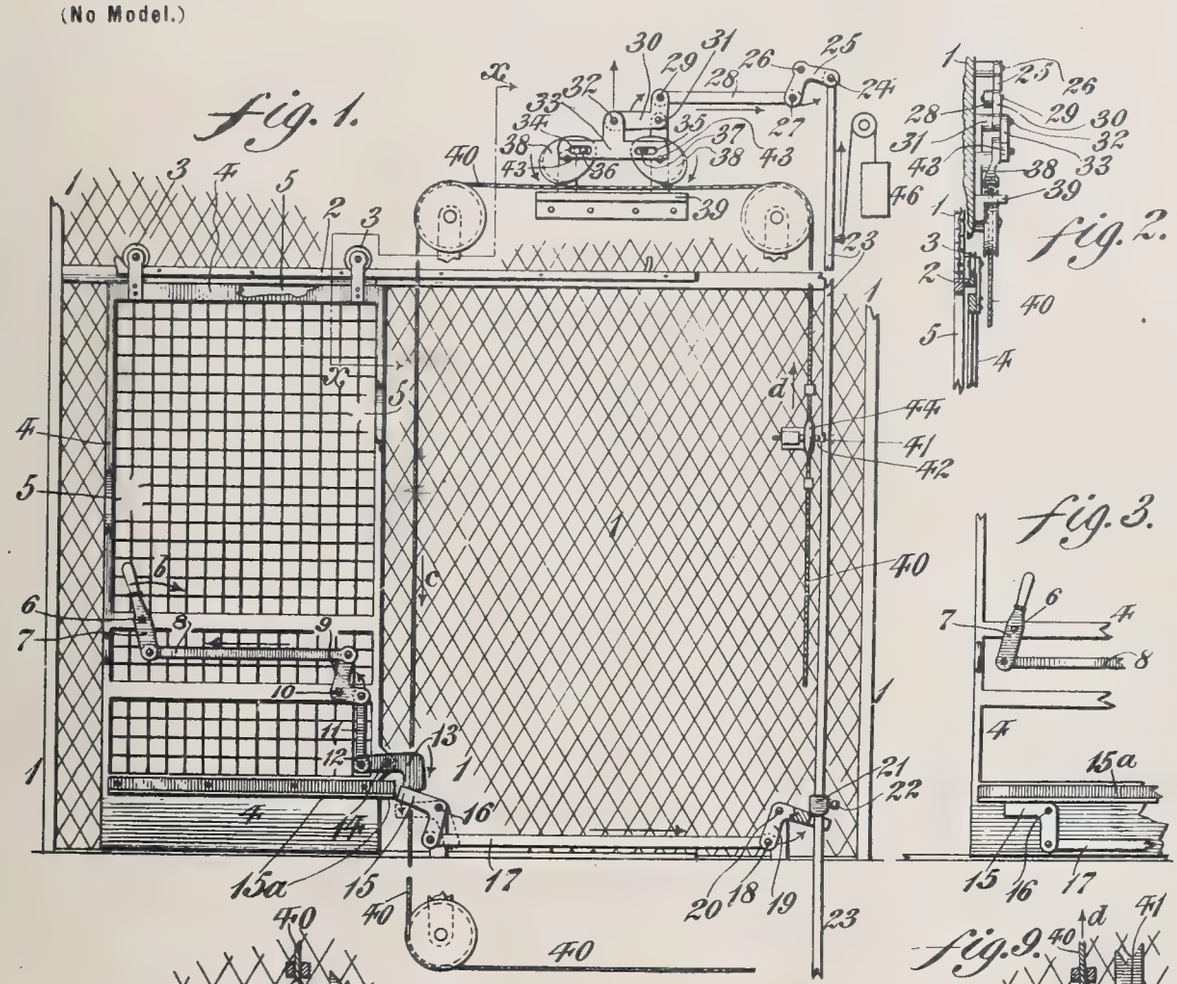


fig. 1.

fig. 2.

fig. 3.

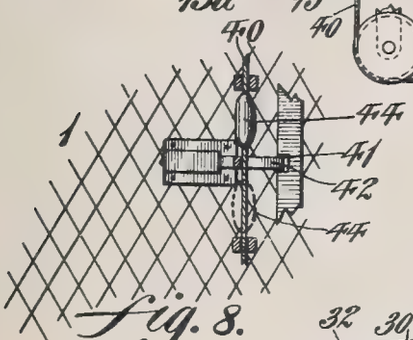


fig. 8.

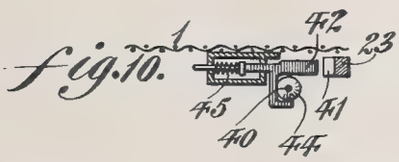


fig. 10.

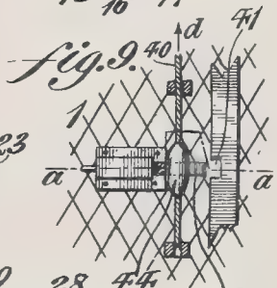


fig. 9.

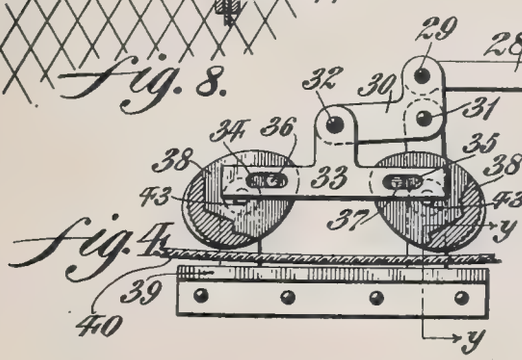


fig. 4.

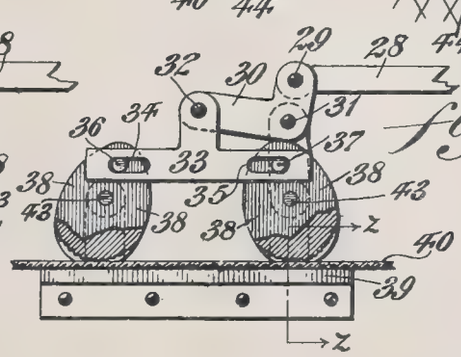


fig. 5.

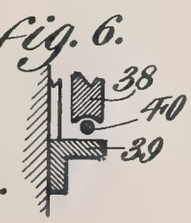


fig. 6.

fig. 7.

Witnesses

L. Lawrille,

P. F. Eagle.

Inventor

Joseph W. Fleming.

By Dieterich & Fairbank

Attorneys

UNITED STATES PATENT OFFICE.

JOSEPH W. FLEMING, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO HIRAM HORTER, JR., OF PHILADELPHIA, PENNSYLVANIA.

SAFETY DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 707,311, dated August 19, 1902.

Application filed April 30, 1902. Serial No. 105,256. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH W. FLEMING, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented new and useful Improvements in Safety Devices for Elevators, of which the following is a specification.

My invention relates to improvements in safety appliances for elevators; and it consists of novel means whereby when the elevator car or cage is moving either up or down all of the doors in the elevator shaft or well are closed and locked and it is impossible to open either of them until the floor of the elevator-car is on a level, or approximately so, with the respective floor of a building.

It also consists of novel means whereby it is impossible to start the elevator-car when the respective door in the shaft or well of the elevator is open or until said door is first closed and locked.

It further consists of novel means whereby any tampering with the doors in the elevator-shaft is prevented.

Figure 1 represents a side elevation of the device as applied to an elevator-shaft. Fig. 2 represents a vertical section on line $x\,x$, Fig. 1. Fig. 3 represents a side elevation of certain of the parts seen in Fig. 1. Fig. 4 represents a partial side elevation and partial vertical section of certain of the parts seen in Fig. 1, the same being on an enlarged scale. Fig. 5 represents a view of the parts shown in Fig. 4, but in different positions. Fig. 6 represents a vertical section on line $y\,y$ in Fig. 4. Fig. 7 represents a vertical section on line $z\,z$, Fig. 5. Fig. 8 represents a side elevation of certain of the parts shown in Fig. 1, the same being on an enlarged scale. Fig. 9 represents a view of the parts shown in Fig. 8, but in different positions. Fig. 10 represents a horizontal section on line $a\,a$, Fig. 9.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings, 1 designates a portion of the inclosure of an elevator-shaft, which latter has located adjacent thereto the bar or rail or runway 2, upon which travel the pulleys 3 on the door 4, which latter is adapted to be moved to the right and the left, so as to either open or close the opening 5 in the shaft-inclosure 1 in the usual manner.

Fulcrumed, as at 6, to the door 4 is a lever 7, which has pivoted thereto one end of a link 8, whose opposite end is pivoted to the bell-crank lever 9, which latter is fulcrumed at 10 to the door 4, it being noted that said lever 9 has also pivoted thereto one end of a link 11, whose opposite end is pivoted at 12 to the lever 13, which latter is pivoted at 14 to the door 4.

One extremity of the lever 13 is adapted to abut at times against a bell-crank lever 15, fulcrumed, as at 16, to the inclosure 1, it being noted that one limb of the lever 15 lies in the path of the foot 15^a, secured to the door 4, so as to normally retain the latter in a locked position, and that said lever 15 has pivoted thereto one end of a link 17, whose opposite end is pivoted, as at 18, to the bell-crank lever 19, which is fulcrumed, as at 20, to the wall of the inclosure 1. A limb of the lever 19 contacts with an adjustable collar 21, secured in the present instance by a set-screw 22 to the rod or bar 23, so that said lever 19 may impart motion to said rod 23 for a purpose hereinafter described, it being understood that said rod 23 is of sufficient length to include all the floors in a building which are used in connection with an elevator provided with the safety device herein referred to.

The upper extremity of the rod 23 is pivoted, as at 24, to a bell-crank lever 25, which latter is fulcrumed at 26 to any convenient fixed point, it being noted that said lever 25 has pivoted thereto, as at 27, one end of a link 28, whose opposite end is pivoted, as at 29, to one extremity of the bell-crank lever 30, which latter is fulcrumed at 31 to any convenient fixed point, it being further noted that the other extremity of said lever 30 has pivoted thereto, as at 32, the cross-head 33, which is provided with slots 34 and 35, which are adapted to receive the pins 36 and 37, which project, respectively, from the eccentric-rollers 38 for a purpose hereinafter described, said rollers being mounted, as at 43, at any fixed points.

Secured to any convenient point and below the eccentrics 38 is a ledge or bed 39, between which and said eccentrics 38 passes the cable

40, which actuates the mechanism for starting and stopping the elevator-car and which may be any of the well-known forms now employed.

The rod 23 is provided with a notch or recess 41, which is normally in alinement with the bolt 42 for a purpose hereinafter described, said bolt being pressed by the spring 45.

It will be noted that the cable 40 is provided with a spindle or tapering shoulder 44, which occupies a position at a right angle to the bolt 42 for a purpose hereinafter described, it being also noted that the casing of the bolt 42 is secured to any suitable fixed point in the elevator-shaft.

The operation is as follows: Assuming the several parts of the device to be in the positions seen in Fig. 1 and that the floor of an elevator-car is on a level with one of the floors of a building, it will be apparent that the door 4 of the elevator-shaft, and which is located on this floor, cannot be opened on account of a limb of the bell-crank lever 15 lying in the path of the foot 15^a, as seen in Fig. 1. When it is desired to open the door 4, the lever 7 is turned in the direction indicated by the arrow *b*, so that said lever 7 will occupy the position seen in Fig. 3. By observing the direction of movements, as indicated by the several arrows in Fig. 1, it will be apparent that the lever 13 will depress that contiguous limb of the lever 15 which normally lies in the path of said foot 15^a, and thus permit the door 4 to be opened, in the present instance by sliding the same to the right. When the door 4 is in its opened position, as seen in Fig. 3, the foot 15^a will retain the lever 15 in the position seen in said Fig. 3, it being apparent that when the door 4 is being opened the bar 15^a rides over the lever 15. It will furthermore be apparent that the rollers 38 are caused to turn on their pivots 43 from their normal positions, as seen in Figs. 1 and 4, to that seen in Fig. 5, whereupon the cable 40 is securely clamped between said rollers 38 and the bed 39 and thereby gripped, (see also Fig. 7,) so that said cable cannot be operated, and the elevator-car consequently cannot be moved until the door 4 is closed, whereupon the several parts will again occupy their normal positions, as seen in Fig. 1, it being noted that as the rollers 38 are then in the positions seen also in Fig. 4 and 6 and the cable 40 is free to move between said rollers 38 and the bed 39, so as to cause motion to be imparted to the elevator-car. When the elevator-car (not shown in the drawings) is at a standstill, the spindle 44 in the cable 40 is in the position seen in Figs. 1, 9, and 10, its swelled or widest portion being adjacent an arm of the bolt 42, whereby said bolt is withdrawn from the recess 41 in the rod 23, and the latter thus permitted to be moved up or down by the operation of the lever 7, so as to either clamp the cable 40 or release the same, as hereinbefore described. In order to cause the car to ascend, it is necessary to pull the cable in the direction indicated by the arrow *c* in Fig. 1. It is apparent that the spindle 44 will be moved from the position seen in Figs. 1, 9, and 10 to that seen in Fig. 8, whereby the bolt 42 is returned by the spring 45, (see Fig. 10,) thus causing said bolt to enter the recess 41 and lock the rod 23, so as to prevent the same from being either raised or lowered when the elevator-car is in motion. When it is desired to cause the car to descend, the cable is pulled in a direction opposite to that indicated by the arrow *c* in Fig. 1, whereupon the spindle 44 is lowered and brought into the position seen in dotted lines, Fig. 8, thus releasing the bolt when the latter returns to its normal position, causing the rod 23 to be locked, as hereinbefore described. It is to be understood that every door in the elevator-shaft 1 is provided with mechanism similar to that seen in connection with the door 4 and that there are as many levers 15 and 19 and links 17 as there are floors communicating with the elevator. In order to assist the rod or bar 23 in its ascent, there is connected therewith the balance-weight 46, the effect of which is evident.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an elevator, a door of the elevator-shaft provided with a foot projecting laterally therefrom, a secondary lever adapted to engage said foot, a cable for operating the power mechanism of the elevator, means connected with said lever for clamping and releasing said cable, and a primary lever adapted to operate said secondary lever to remove the latter from the path of said foot.

2. In an elevator, a door of the elevator-shaft, a primary lever mounted thereon, a secondary lever mounted on the elevator-shaft, a foot on the door adapted to be engaged by said secondary lever, means on the door for operating said primary lever and thereby removing the secondary lever from the path of said foot, and means connected with the secondary lever for operating mechanism that engages and releases the starting and stopping cable of the elevator.

3. In an elevator, a bar, mechanism controlling the same operated from the door of the elevator-shaft, a starting and stopping cable, mechanism connected with said bar adapted to engage said cable, a lock on the elevator-shaft adapted to engage said bar, and means on said cable adapted to engage said lock and throw back the same.

4. In an elevator, a starting and stopping cable, means for controlling the same, a lock adapted to engage a member of said means, and a device on said cable adapted in its motion to engage said lock and throw back the same from said member.

5. In an elevator, a starting and stopping cable, a bed over which the same passes, an eccentric-roller opposite to said bed, a support for said roller, means for lowering and

raising said roller, and connections for said means with devices extending from the door of the elevator and the elevator-shaft, whereby the support of said roller is moved in opposite direction.

6. In an elevator, a starting and stopping cable, a locking device therefor, and means for releasing a member of said device from the lock itself consisting of a shoulder on said cable, and a projection on the bolt of said lock, said projection being adapted to be engaged by said shoulder.

7. In an elevator, a bar, a starting and stopping cable, a door provided with means for operating said bar, and a clamping device for said cable adapted to be operated by said bar, in combination with a lock on the elevator-shaft adapted to engage said bar and means on said cable adapted to engage the bolt of said lock.

8. In an elevator, a door of the elevator-shaft, a primary lever mounted thereon, a secondary lever mounted on the elevator-shaft, a foot on said door adapted to be engaged by said secondary lever, said secondary lever being adapted to be moved from the path of said foot by said primary lever, a movable bar connected with said secondary lever and a device adapted to be operated by said movable bar and grip the starting and stopping cable of the elevator and to be released therefrom.

JOSEPH W. FLEMING.

Witnesses:
JOHN A. WIEDERSHEIM,
C. D. MCVAY.

No. 718,230. PATENTED JAN. 13, 1903.

W. H. B. TEAMER.

ELEVATOR.

APPLICATION FILED APR. 11, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig 1.

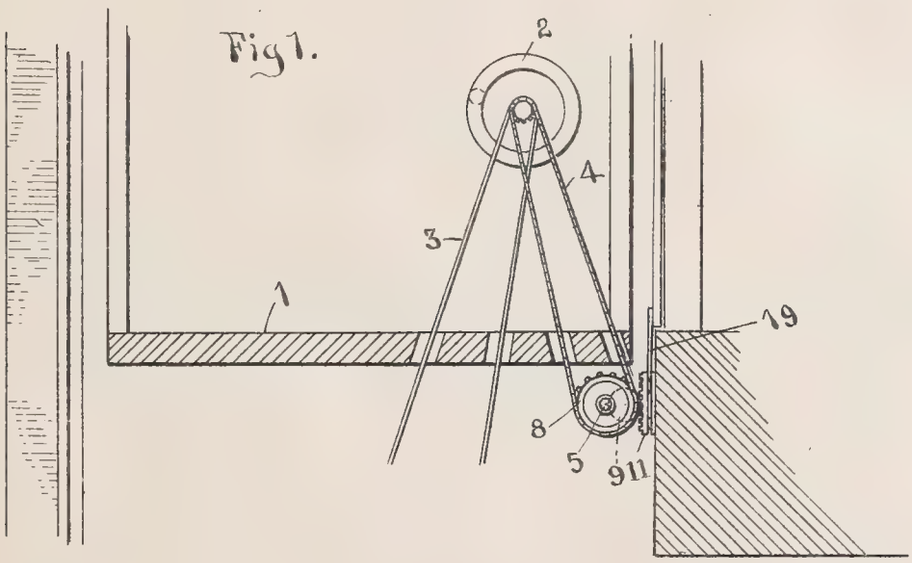
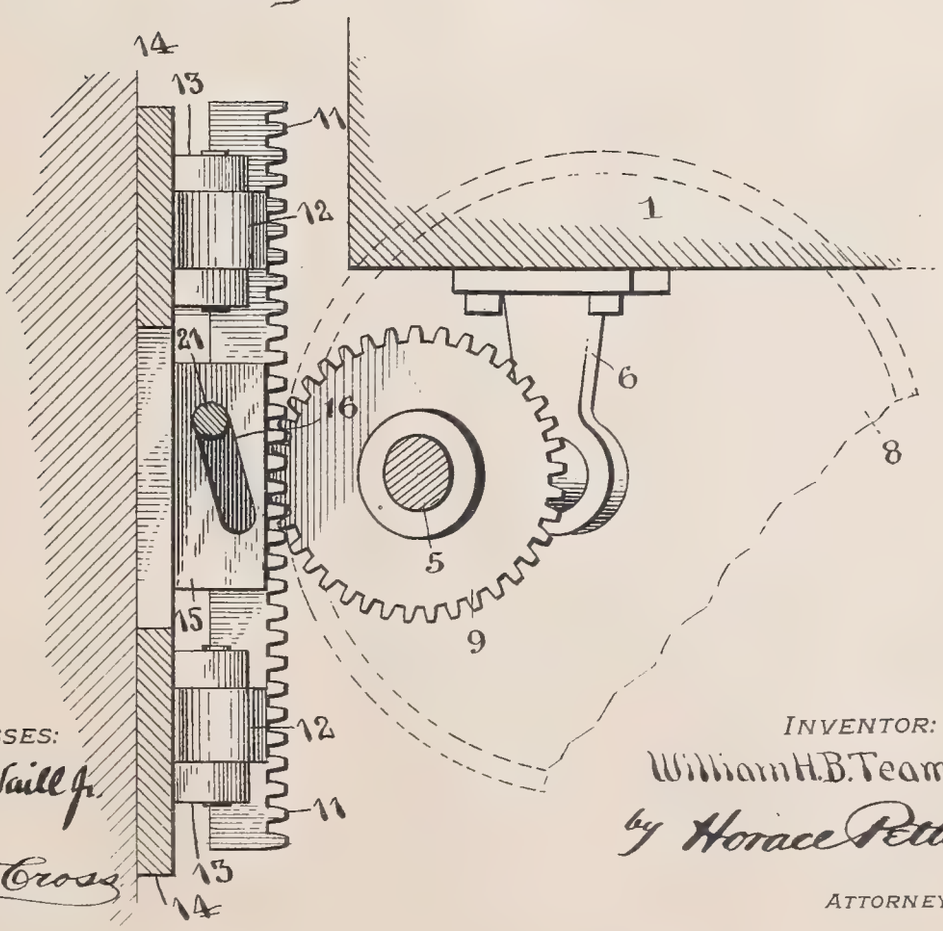


Fig 2.



WITNESSES:

Edw. W. Vaill Jr.

Jno. T. Cross

INVENTOR:

William H. B. Teamer.

by Horace Pettit

ATTORNEY:

No. 718,230. PATENTED JAN. 13, 1903.

W. H. B. TEAMER.

ELEVATOR.

APPLICATION FILED APR. 11, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

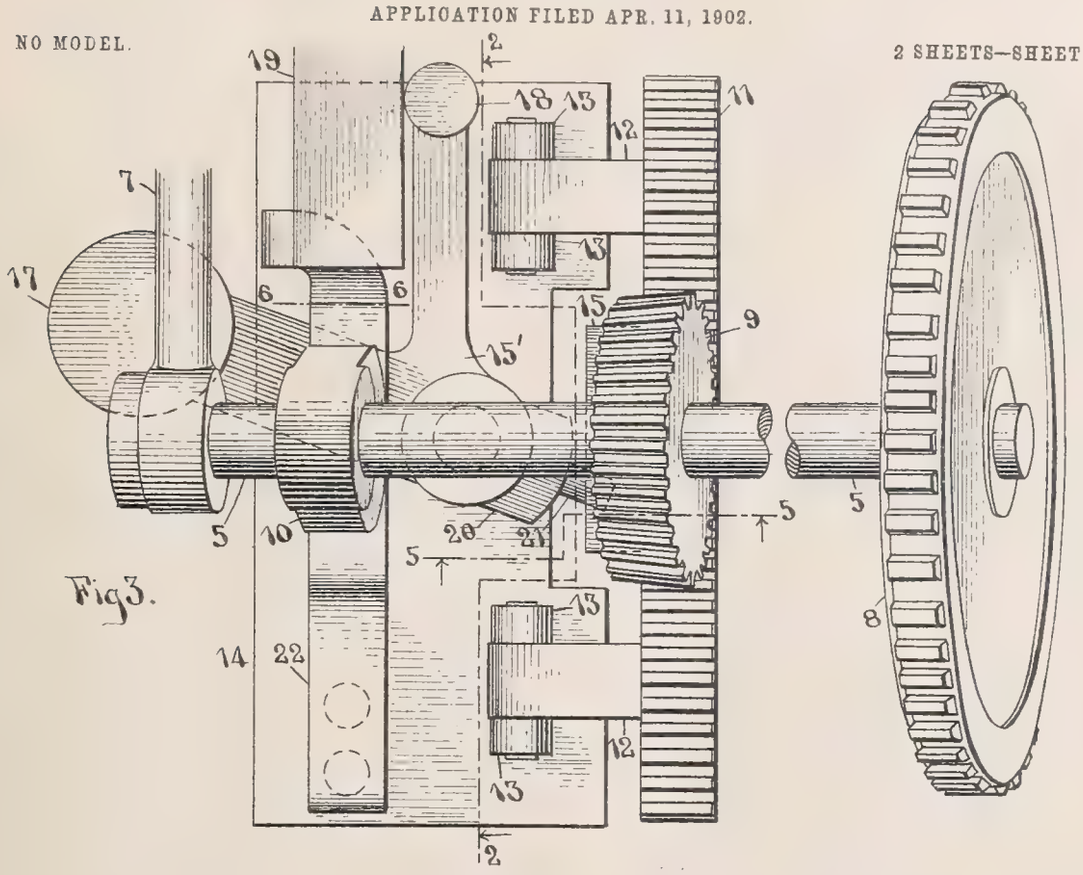


Fig 3.

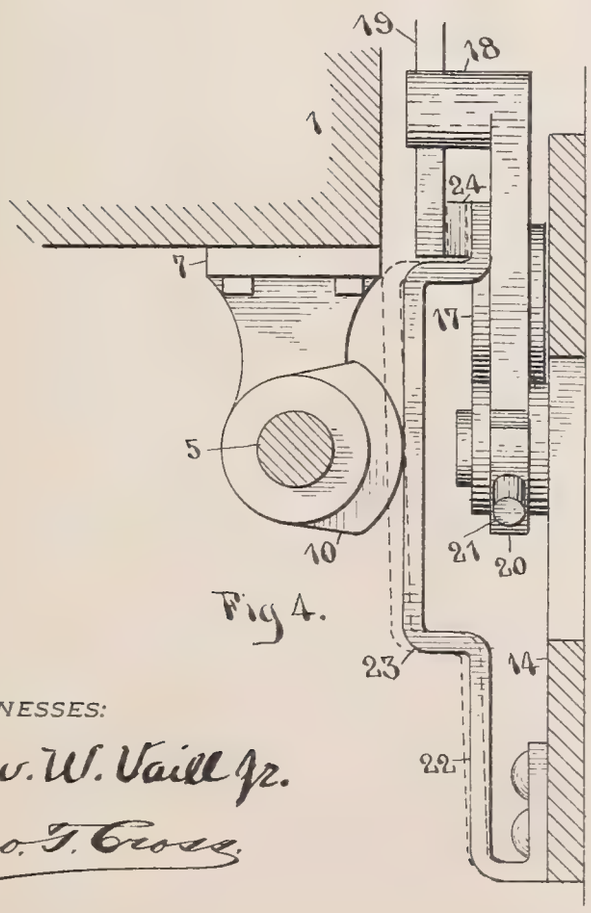


Fig 4.

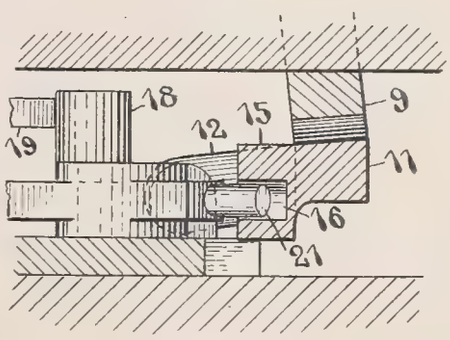


Fig 5.

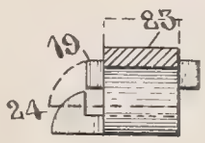


Fig 6.

WITNESSES:

Edw. W. Vaill Jr.

Jno. T. Cross.

INVENTOR:

William H. B. Teamer.

by Horace Pettit

ATTORNEY.

UNITED STATES PATENT OFFICE.

WILLIAM H. B. TEAMER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF TWO-THIRDS TO JOSEPH RAMSEY AND ISAAC ALLOWAYS, OF PHILADELPHIA, PENNSYLVANIA.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 718,230, dated January 13, 1903.

Application filed April 11, 1902. Serial No. 102,381. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. B. TEAMER, a citizen of the United States, and a resident of the city of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Elevators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates generally to an improvement in elevators, and particularly to an improved mechanism for automatically controlling the car at landings.

One of the main objects of my invention is to provide means whereby the car when stopped at a landing or floor may be automatically held in such position so long as the landing-door is open and movement due to any defective action of the controlling mechanism compensated for automatically until the said door is closed.

A further object of my device is to provide means whereby the elevator is immediately and automatically made to return to its proper position at the landing should the controlling mechanism operate improperly or the valves leak sufficiently to cause the elevator to commence its movement either in an upward or downward direction.

Another object is to provide mechanism in combination with that above referred to whereby the landing-door is locked in its closed position at all times other than those when the elevator is not at that particular landing or within a predetermined distance of the same.

For a detailed description of my invention reference may be had to the following specification and to the accompanying drawings, forming a part of the same, in which—

Figure 1 shows a side elevation of a car embodying my device, one side of the car being shown removed. Fig. 2 is a sectional view of the mechanism carried by the car and the coacting mechanism located at a landing, showing the same engaged and taken substantially on the line 2 2, Fig. 3, and looking toward the right. Fig. 3 is an elevation of the car and landing mechanism, the operating-shaft being shown as shortened for convenience. Fig. 4 is a sectional view of the same parts, taken substantially upon the line 2 2, Fig. 3, but looking toward the left. Fig. 5 is a sectional view taken substantially upon the line 5 5, Fig. 3, looking toward the right; and Fig. 6 is a sectional view of the lower end of the door-bar and locking-hook, taken substantially upon the line 6 6, Fig. 3.

Similar reference-numerals indicate like parts upon the several figures of the drawings.

Referring to Fig. 1, the numeral 1 indicates the body portion of the car, having the usual controller-wheel 2 or its equivalent and the usual chain or belt 3, running to those parts of the controlling mechanism carried by the car. 4 is an auxiliary sprocket-chain which connects the mechanism for holding the car at the landing with the controller-wheel 2. At the bottom of the car, near the edge of the same, is supported a shaft 5 in suitable bearings 6 and 7. This shaft 5 has fixed or keyed upon it three parts—to wit, a sprocket-wheel 8, a gear-wheel 9, and a cam or arm 10. The sprocket-chain 4 passes around the sprocket-wheel 8 and so connects the shaft with the controller-wheel. The parts thus far described constitute those carried by the car.

Upon the vertical portion of the hatch, between the floor and the lower ceiling, is hinged or otherwise held the vertical rack 11 and is adapted to be thrown into and out of engagement with the gear-wheel 9, which is located in a vertical plane with the same upon the shaft 5, carried by the car 1. In this instance the rack carries the projections 12 12, which are pivoted to the standards 13 13, carried by the base-plate 14, which is fixed to the hatch; but said rack may be secured in any suitable way, provided it is free to move toward and away from the gear-wheel to engage the same. The rack carries a projection 15, within which is a diagonal or inclined slot 16. Said slot 16 is adapted to be engaged by a vertically-oscillating pin, hereinafter to be described, to move the rack inward and outward.

Upon the base-plate 14 is pivoted the bell-crank lever 15', having one end weighted, as at 17, and its other end provided with a projection 18. A locking-bar 19 projects downwardly from the landing-door, and when the same is closed bears against the projection 18, holding the same at the limit of its move-

ment toward the right. A portion 20 projects from the hub of the bell-crank lever and carries a pin or projection 21, which is adapted to engage the slot 16 in the projection 15, carried by the rack. It will be seen that when the landing-door is opened the bar 19 will be moved toward the left, thus releasing the bell-crank lever and allowing it to turn about its pivot. This movement about the pivot will cause the pin 21 to travel upwardly in the inclined slot 16, and thereby move the rack 11 outwardly to engage the gear 9. The reverse movement of the bar 19 will cause the rack 11 to be disengaged from the gear 9.

To the lower portion of the plate 14 is fixed a spring-arm 22, which is in a vertical plane with the arm 10 on the shaft 5. This arm 22 has a raised portion 23, which extends upward and downwardly a predetermined distance from a fixed line which represents the position when the floor of the elevator is exactly level with the floor at a landing. These distances are fixed by the municipal regulations of some cities to three inches. The spring-arm 22 is provided with a hooked or barbed portion 24 at its upper end, which is adapted to engage the lower end of the locking-bar 19 of the landing-door. The relation between the arm 10 and the car-controlling mechanism is such that when the said mechanism is in the position to stop the elevator the arm 10 will be in a horizontal position and will bear upon the spring 22 at its raised part 23, so as to disengage the hook 24 from the end of the door-bar 19. It will be seen that if the car stops in such a position as to bring the arm 10 within the space limited by the raised portion 23 the door may be opened. The opening of the door will release the bell-crank lever and so raise the rack 11 and cause the same to mesh with the gear-wheel 9. This will not only lock the controller-wheel 2, so that it cannot be turned by a person within the car, but should the controlling mechanism or valves leak and cause the elevator to "creep" the controlling mechanism would be automatically operated to compensate for the creeping motion, either by closing the valve or by reversing the controller to give a slight motion to the car in an opposite direction. This is made possible from the fact that the rack 11 is fixed, and any motion of the car causes the gear 9 to travel along the rack and rotate the shaft 5. For example, referring to Fig. 1, a clockwise motion of the controller-wheel 2 will start the car downwardly and an anticlockwise motion will start the car upward. Should the controlling mechanism be defective and cause the car to creep in an upward direction, the rack 11 being stationary, the shaft 5, and consequently the wheel 2, will be turned slightly in a clockwise direction, which will just compensate for the upward motion by bringing the car to a stop or give the car a slight downward motion, depending on the adjustment and relations of the various parts. In the latter case the downward motion after a slight distance has been passed over would again reverse the controller, and the car would slowly reciprocate at the landing between limits depending upon the amount of leakage and the "lost motion" between the parts. It will thus be seen that I have produced a device which will accomplish the objects above enumerated and by means of simple and efficient mechanism which is applicable to different forms of elevator-operating mechanisms now in use, including hydraulic, steam, electric, &c.

The shaft 5, which carries the sprocket 8 and gear 9, is preferably made in two sections and connected by a universal joint, so that the end which carries the gear 9 may be inclined outward toward the landing, so as to bring said gear in a position to be engaged by the rack 11. This construction is resorted to in practice because the gear 9 is much smaller in diameter than the sprocket-wheel 8. The gear 9 must necessarily be beveled in proportion to the incline of the shaft, in order that it may properly mesh with the rack 11.

Minor changes in details and arrangement of parts may be made without departing from the spirit of my invention.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In combination, an elevator-car, a landing, controlling mechanism, a controller member located upon the car, means at the landing to lock the controller member and to compensate for movement of the car while adjacent the landing at which it is desired to stop the car and connections between said means and controller member, substantially as described.

2. In combination, an elevator-car, a landing, controlling mechanism, a pivoted controller member located upon the car, means at the landing to lock the controller member from rotation while the car is stationary and to compensate for movement of the car due to defective action of the controlling mechanism, and connections between said means and controller member, substantially as described.

3. In combination, an elevator-car, a landing, a door therefor, controlling mechanism, means for locking the landing-door when the car is more than a predetermined distance from the landing, and means operated by the door-locking means, to lock the controlling mechanism and to compensate for movement of the car while adjacent the landing at which it is desired to stop the car, substantially as described.

4. In combination, an elevator-car, a landing, a door therefor, controlling mechanism, a controller member located upon the car, means for locking the landing-door when the car is more than a predetermined distance from the landing, and means operated by the door-locking means to lock the controller

member and to compensate for movement of the car while adjacent the landing at which it is desired to stop the car, substantially as described.

5. In combination, an elevator-car, a landing, a door therefor, controlling mechanism, means located at the landing for locking the landing-door, means carried by the car for operating said locking means, and means operated by said door-locking means for locking the controlling mechanism, and to compensate for movement of the car while adjacent the landing at which it is desired to stop the car, substantially as described.

6. In combination, an elevator-car, a landing, a door therefor, controlling mechanism, a controller member located upon the car, means located at the landing for locking the landing-door, means carried by the car for operating said locking means, and means operated by said door-locking means for locking the controller member, and to compensate for movement of the car, while adjacent the landing at which it is desired to stop the car, substantially as described.

7. In combination, an elevator-car, a landing, a door therefor, controlling mechanism, means located upon the car and connected with the controlling mechanism for locking the latter and for giving the same a movement to compensate for a movement of the car due to defective action of the controlling mechanism and means located at landing for locking the landing-door and for actuating said means for operating the controlling mechanism, substantially as described.

8. In combination, an elevator-car, a landing, a door therefor, controlling mechanism, a gear, a rack, means connecting said gear and rack with the controlling mechanism, means for giving said gear and rack a relative movement to cause the same to mesh and unmesh, and means for operating said latter means when the car is within a predetermined distance of a landing, substantially as described.

9. In combination, an elevator-car, a landing-door, controlling mechanism, a gear, a rack, means connecting said gear and rack with the controlling mechanism, means for giving said gear and rack a relative movement to cause the same to mesh and unmesh, and door-locking means, said door-locking means being connected with said gear and rack meshing means to operate the same, substantially as described.

10. In combination, an elevator-car, a landing, a door therefor, controlling mechanism, a shaft carried by a car and operatively connected with said controlling mechanism, a cam or arm carried by said shaft, a gear also carried by said shaft, means for locking the door located at the landing and adapted to be operated by said arm, a rack also located at the landing and adapted to engage said gear, and connections between said rack and said door-locking means to operate the former to cause the same to mesh and unmesh with said gear, substantially as described.

11. In combination, an elevator-car, a landing, controlling mechanism, a shaft carried by the car and operatively connected with said controlling mechanism, a cam or arm carried by said shaft, a gear also carried by said shaft, a door at the landing, a locking-bar projecting from said door, means to engage said bar to lock said door and adapted to be operated by said arm, a bell-crank lever having one weighted arm and a second arm adapted to engage said door-locking bar, a projection carried by said bell-crank lever, a rack located at the landing and adapted to move transversely to engage said gear, a part having a diagonal slot carried by said rack adapted to engage said projection, whereby the oscillation of the bell-crank lever will operate said rack and cause the same to mesh and unmesh with said gear, substantially as described.

In witness whereof I have hereunto set my hand this 5th day of April, 1902.

WILLIAM H. B. TEAMER.

Witnesses:
JNO. T. CROSS,
CHAS. K. BENNETT.

No. 739,782. PATENTED SEPT. 22, 1903.

G. HAIL.

ELEVATOR SAFETY DEVICE.

APPLICATION FILED JUNE 25, 1903.

NO MODEL.

Fig. 1.

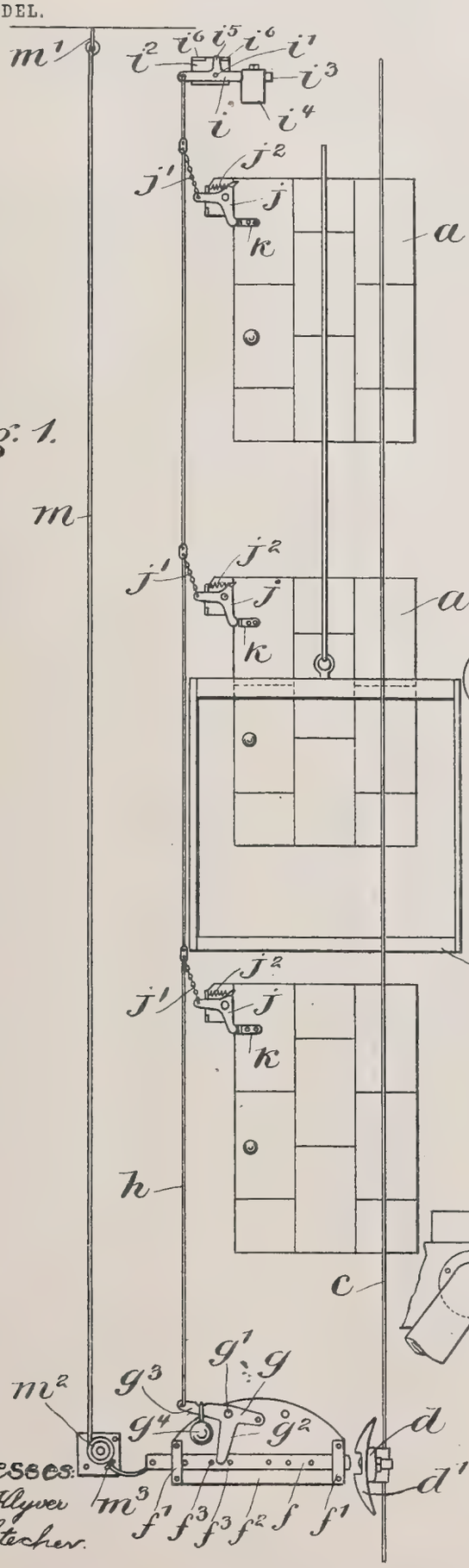


Fig. 2.

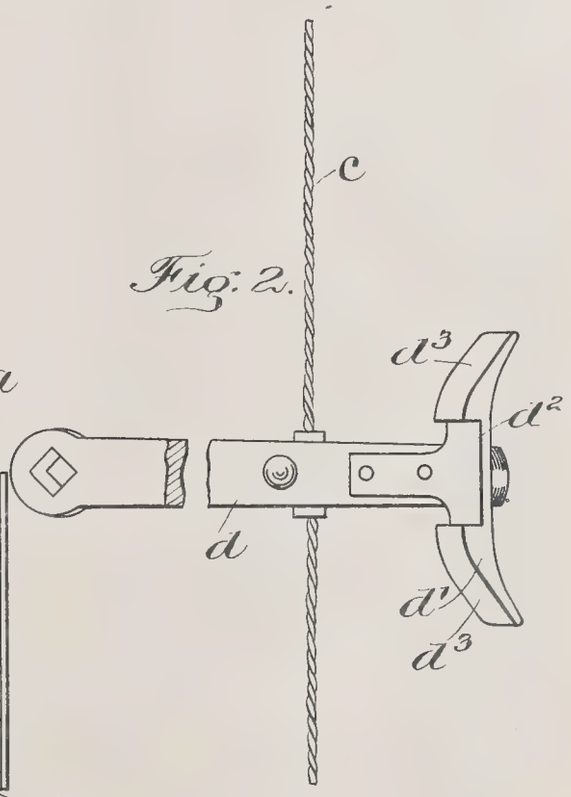
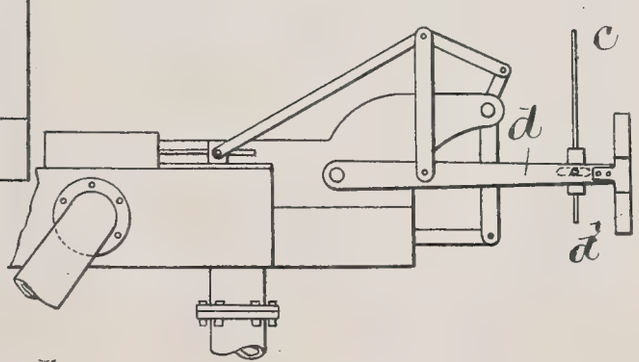


Fig. 3.



Witnesses:
Albert Flyer
C. C. Stecher.

Inventor:
Geo. Hail
by Wright Brown Quinby
his attys

No. 739,782. Patented September 22, 1903.

UNITED STATES PATENT OFFICE.

GEORGE HAIL, OF PROVIDENCE, RHODE ISLAND.

ELEVATOR SAFETY DEVICE.

SPECIFICATION forming part of Letters Patent No. 739,782, dated September 22, 1903.

Original application filed November 13, 1902, Serial No. 131,096. Divided and this application filed June 25, 1903. Serial No. 162,985. (No model.)

To all whom it may concern:

Be it known that I, GEORGE HAIL, of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Elevator Safety Devices, of which the following is a specification.

This invention has relation to door-controlled elevator safety appliances of the type including a lock for preventing the movement of a car when a door is open, and has for its object the provision of supplemental means for withdrawing the lock to an inactive position to permit a movement of the car while a door remains open—as, for instance, when the lock has moved to active position by the opening of a door remote from the car and it is necessary to release the lock in order to raise or lower the car to permit the attendant to close said door.

To this end the invention consists of the improvements illustrated by the accompanying drawings, described in the following specification, and pointed out in the appended claims.

Referring to said drawings, Figure 1 represents a series of landing-doors opening into a well, a car, a valve-lever, door-controlled locking mechanism therefor, and supplemental means for freeing the lever from the lock. Fig. 2 represents in perspective view the valve-lever or motor-controller and the controlling-line connected thereto. Fig. 3 represents the motor-controlling mechanism.

On the drawings, *a a* indicate the landing-doors, which are normally closed, and *b* the elevator-car.

c indicates the rope, which may be actuated by the attendant on the car. The rope or line *c* is connected to the lever *d* of the ordinary valve mechanism, (indicated at *e* in Fig. 3.) By raising or lowering the line the lever *d* may be shifted to cause the admission of fluid into the hoisting mechanism or to cut off the supply therefrom in the well-known way.

The locking mechanism, by which the lever *d* may be held against movement, includes a member *f*, (which for convenience in nomenclature may be termed a "bolt," although by that term there is no intention of limiting the member to any particular form or shape.) This bolt is reversible from end to end and is mounted in guides *f'* on a supporting-plate f^2. This bolt is caused to engage a locking member on the lever *d* when any one of the doors *a* is opened. For this purpose the lever *d* is provided with a bow *d'*, having a notch d^2 to receive the end of the bolt and with inclined surfaces d^3. The notch is wide enough to allow the slight relative movement of the lever which is necessary to permit the requisite loose or idle movement of the valve when it is in a neutral position. When the bolt is projected and the lever is out of neutral position, the swinging of the lever upon its fulcrum toward neutral or central position will force the bolt gradually backward until its end registers with the notch in the member *d'*, whereupon the bolt will snap forward and enter the notch, as will be explained.

Pivoted upon the plate f^2 is a T-shaped lever *g*, the pivot or fulcrum for which is indicated at *g'*. One arm g^2 projects downwardly between two studs f^3 f^3 on the bolt, while to another arm g^3 is connected the lower end of a line *h*, which extends upward through the well and is connected at its upper end to one arm of a three-armed lever *i*. This last-mentioned lever *i* is pivoted at *i'* to a bracket i^2, and it has an arm i^3, with a weight i^4 adjustably secured thereto. This weight i^4 is sufficient to overbalance the line *h*, the T-shaped lever *g*, and the weight g^4, carried thereby, and to move the bolt *f* to inactive position, as shown in Fig. 1. The lever *i* is further provided with a third arm i^5, adapted to play between stops i^6 on the bracket i^2.

When the line *h* is pulled downward, the weight g^4 swings the lever *g* about its fulcrum and forces the bolt *f* yieldingly forward to active position, so as to engage the locking member on the lever *d*. In proximity to each door *a* there is a bell-crank *j*, flexibly connected with the line *h* by a chain or other connection *j'*. Connected to a short arm on each bell-crank there is a spring j^2, which when the door is open is of sufficient strength to swing the lever or bell-crank *j* about its pivot and draw down the line *h* and permit

the weight g^4 to move the bolt to active position.

Each door carries a projection k, adapted to engage one arm of the bell-crank j and move it to the position shown in Fig. 1, so as to permit the weight j^4 to raise the line h and swing the lever g into the position shown. This particular form of operative means between the doors and the lever g is illustrated in Letters Patent No. 657,597, granted to Edward L. Hail and George Hail, September 11, 1900, and is not herein claimed as new.

In order to withdraw the bolt to inactive position either by the attendant on the car or by a person from any one of the landing-doors for the purpose hereinbefore described, the following mechanism is employed: A flexible line m is connected at its upper end to an eyebolt m' at the upper end of the top of the elevator-well, and it extends down from the well in position to be reached from any one of the landing-doors or from the car.

As Fig. 1 is a more or less conventional illustration of the doors and the car, the line is shown to one side to prevent confusion; but it will be understood that it may pass through the car, if desired.

The lower end of the line m passes around a grooved pulley m^2 and through an eye m^3 and is attached to the rear end of the bolt f. In virtue of this construction the attendant on the car or the janitor at any one of the landing-doors may draw upon the line m and retract the bolt f, so that the lever d may be actuated to cause the car to travel upward or downward in the elevator-well. This is a desirable feature, for, as previously explained, a door might be accidentally opened while the car is at rest opposite another landing-door. So long as the door remains open it would be impossible to start the car without sending some one to close it. With this construction the lever may be freed to permit the car to travel to the open door. This freeing mechanism is of great benefit to elevator repairers and janitors by enabling them to move the car from the car itself or from the landing, as they desire, while working upon or around the car, regardless as to whether the doors are open or closed.

The valve-lever may be referred to as the "controller" and the valve as the "motor-controlling mechanism," whereas the line m may be referred to as "means operable independently of the means for actuating the lock for rendering said lock inoperative or inactive."

This is a division of application Serial No. 131,096, filed November 13, 1902.

Having thus explained the nature of the invention and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made or all of the modes of its use, I declare that what I claim is—

1. A safety appliance for elevators comprising a controller, motor-controlling mechanism to which said controller is connected, a a car, a door, a locking device in juxtaposition to said motor-controlling mechanism, operative means whereby said locking device is actuated to lock the said motor-controlling mechanism when the door is open, and means unconnected with and operable independently of the aforesaid operative means for rendering said locking device inoperative.

2. A safety appliance for elevators comprising a controller, motor-controlling mechanism to which said controller is connected, a car, a door, a locking device in juxtaposition to said motor-controlling mechanism, operative means whereby said locking device is actuated to lock the said motor-controlling mechanism when the door is open, and independent mechanical means for rendering said locking device inoperative.

3. A safety appliance for elevators comprising a controller, motor-controlling mechanism to which said controller is connected, a car, a series of landing-doors, a locking device in juxtaposition to said motor-controlling mechanism, operative means whereby said locking device is actuated to lock the said motor-controlling mechanism when any one of said landing-doors is open, and means independent of the aforesaid operative means, extending to the topmost landing-door and adapted to be operated to render said locking device inoperative.

4. A safety appliance for elevators comprising a controller, motor-controlling mechanism to which said controller is connected, a car, a series of landing-doors, a locking device in juxtaposition to said motor-controlling mechanism, operative means whereby said locking device is actuated to lock the said motor-controlling mechanism when any one of said landing-doors is open, and means independent of the aforesaid operative means and adapted to be operated from any one of said landing-doors to render said locking device inoperative.

5. A safety appliance for elevators comprising a car, a door, a controller, valve mechanism connected with the controller, a lock containing a bolt, operative means whereby said bolt is actuated to lock the valve mechanism when the door is open, and means unconnected with and independent of the aforesaid operative means for moving said bolt to inoperative position.

6. A safety appliance for elevators comprising a car, a door, a controller, valve mechanism connected with the controller, a lock containing a bolt, operative means whereby said bolt is actuated to lock the valve mechanism when the door is open, and independent mechanical means for moving said bolt to inoperative position.

7. A safety appliance for elevators comprising a car, a door, a controller, valve mechanism connected with the controller, a lock con-

taining a bolt, actuating means whereby said bolt is actuated to lock the valve mechanism when the door is open, and independent mechanical means adapted to be manipulated for moving said bolt to inoperative position.

8. A safety appliance for elevators comprising a car, a door, a controller, valve mechanism connected with the controller, a lock containing a bolt, actuating means whereby said bolt is actuated to lock the valve mechanism when the door is open, and means in the well unconnected with and independent of said actuating means and operable from the car for moving said bolt to inoperative position.

9. A safety appliance for elevators comprising a car, valve mechanism, a lock therefor containing a bolt, a door, operative means whereby the said lock is actuated when the door is open, and means unconnected with and independent of the aforesaid operative means, connected to said bolt and adapted to be manipulated from the car.

10. A safety appliance for elevators comprising a car, valve mechanism, a lock therefor containing a bolt, a door, means whereby the said lock is actuated when the door is open, and independent mechanical means connected to said bolt and adapted to be manipulated from the car.

11. A safety appliance for elevators comprising a car, valve mechanism, a lock therefor containing a bolt, a door-actuating means whereby the said lock is actuated when the door is open, and means in the well unconnected with and independent of said actuating means, connected to said bolt and adapted to be operated to move said bolt to inoperative position.

12. A safety appliance for elevators comprising a car, valve mechanism, a lock therefor containing a bolt, a door, actuating means whereby the said lock is actuated when the door is open, and independent mechanical means in the well, connected to said bolt and adapted to be operated from the car.

13. A safety appliance for elevators comprising a valve mechanism, a lock therefor containing a bolt, a landing-door, operative means whereby the said lock is actuated when the landing-door is open, and means in the well independent of the aforesaid operative means, connected to said bolt and adapted to be manipulated from the said landing-door.

In testimony whereof I have affixed my signature in presence of two witnesses.

GEORGE HAIL.

Witnesses:
WALTER S. REYNOLDS,
THOMAS J. HALLER.

No. 747,317. PATENTED DEC. 15, 1903.

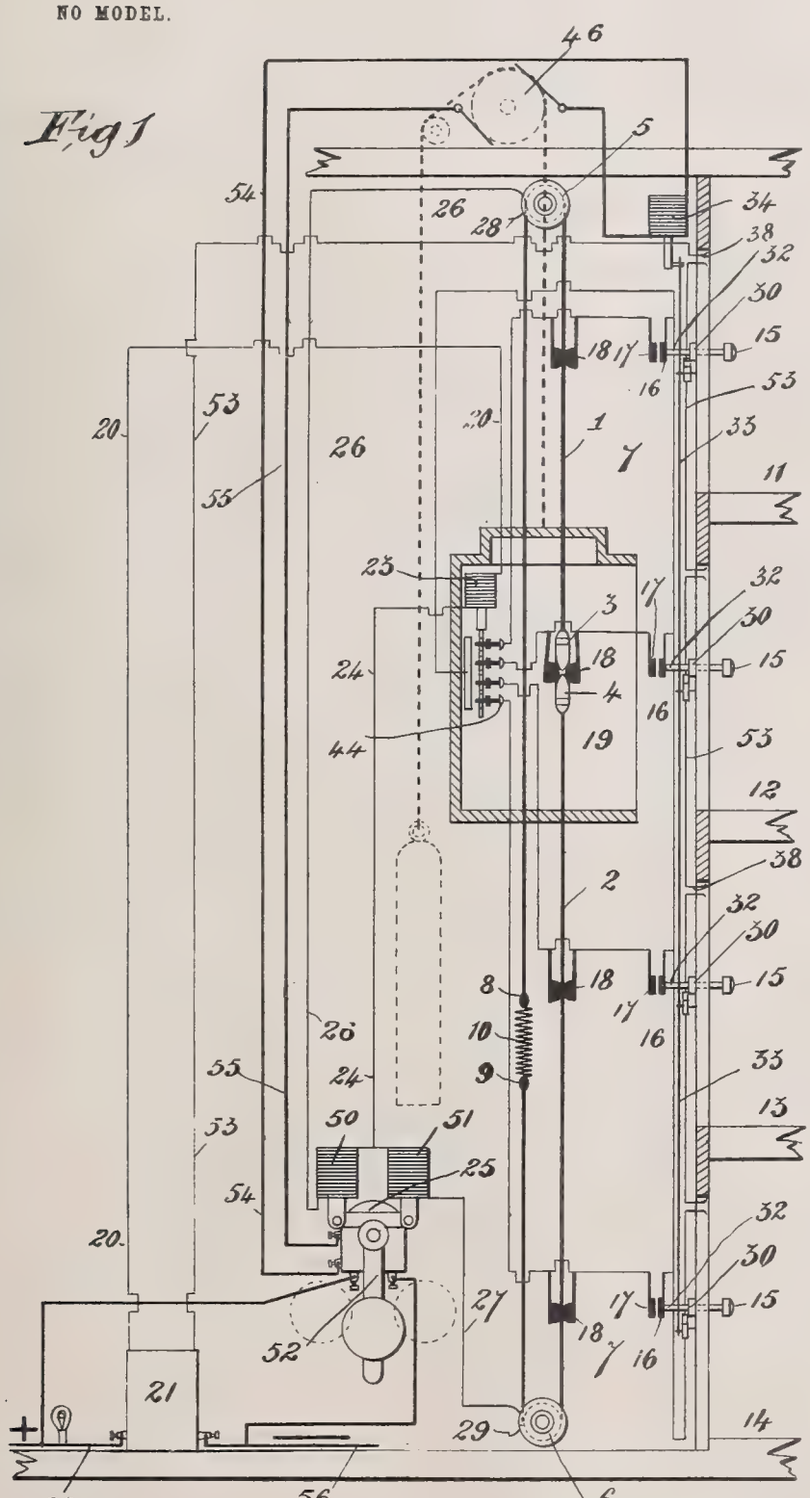
R. F. CAREY.

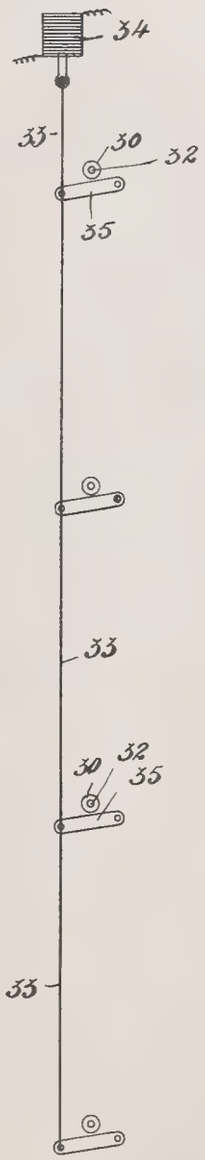
LIFT.

APPLICATION FILED JULY 13, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

Fig 1





Witnesses:

James L. Norris Jr.

Inventor

Robert F. Carey

By

James L. Norris.

Atty.

THE NORRIS PETERS CO., WASHINGTON, D. C

No. 747,317. PATENTED DEC. 15, 1903.

R. F. CAREY.

LIFT.

APPLICATION FILED JULY 13, 1903.

NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2.

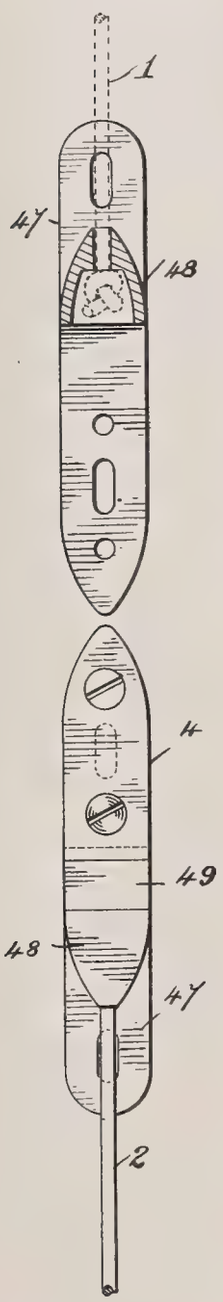


Fig. 3.

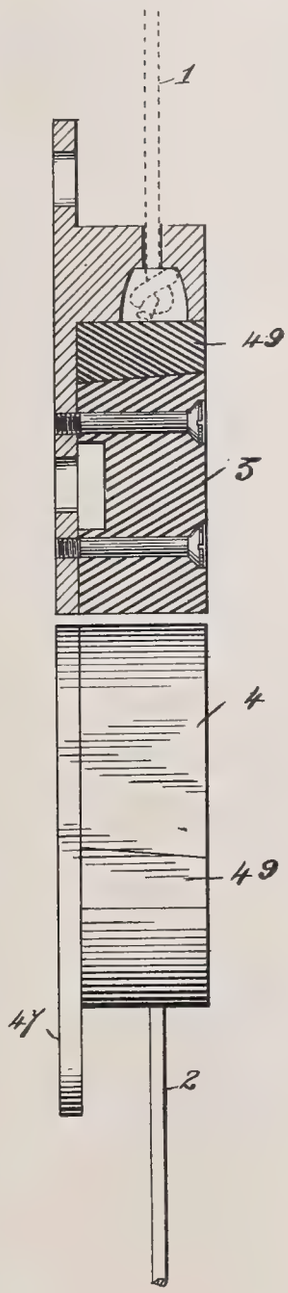
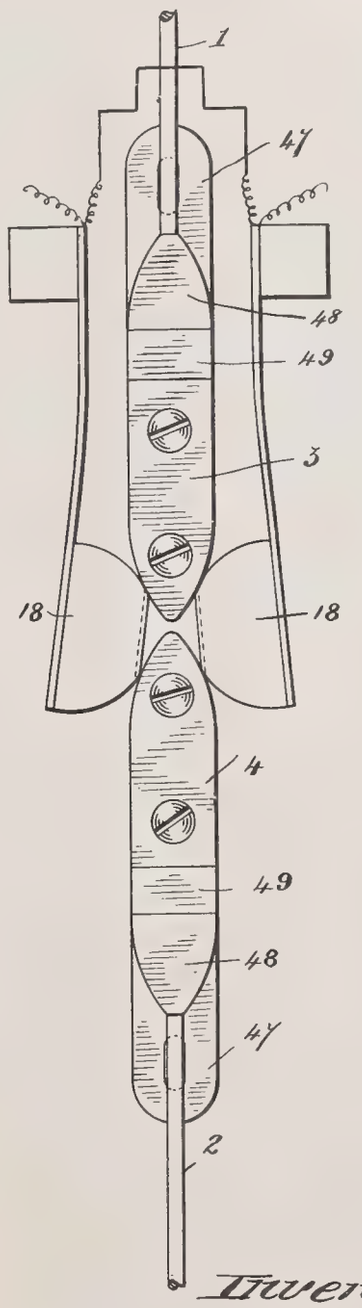


Fig. 4.



Witnesses:

W. B. Tuttle

James L. Norris, Jr.

Inventor

Robert F. Carey

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James L. Norris.

Abby

THE NORRIS PETERS CO., WASHINGTON, D. C

No. 747,317. PATENTED DEC. 15, 1903.

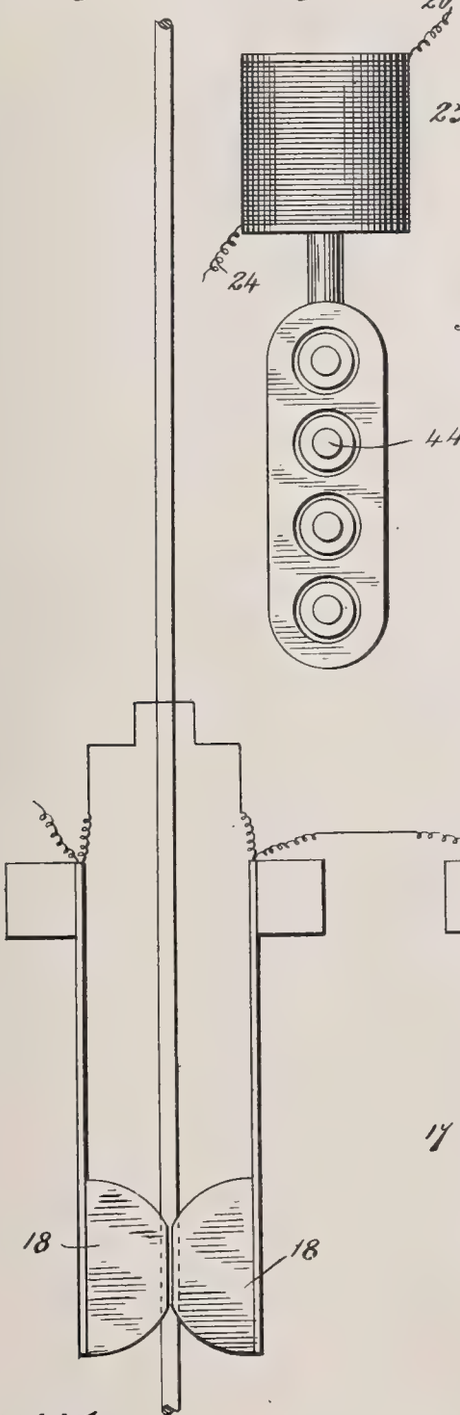
R. F. CAREY.

LIFT.

APPLICATION FILED JULY 13, 1903.

NO MODEL. 4 SHEETS—SHEET 3.

Fig. 5.



Witnesses:

James L. Norris, Jr.

Fig. 8.

Fig 6

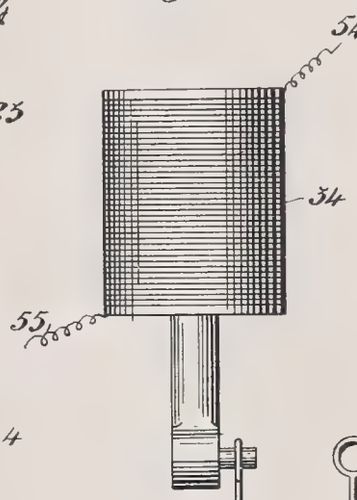
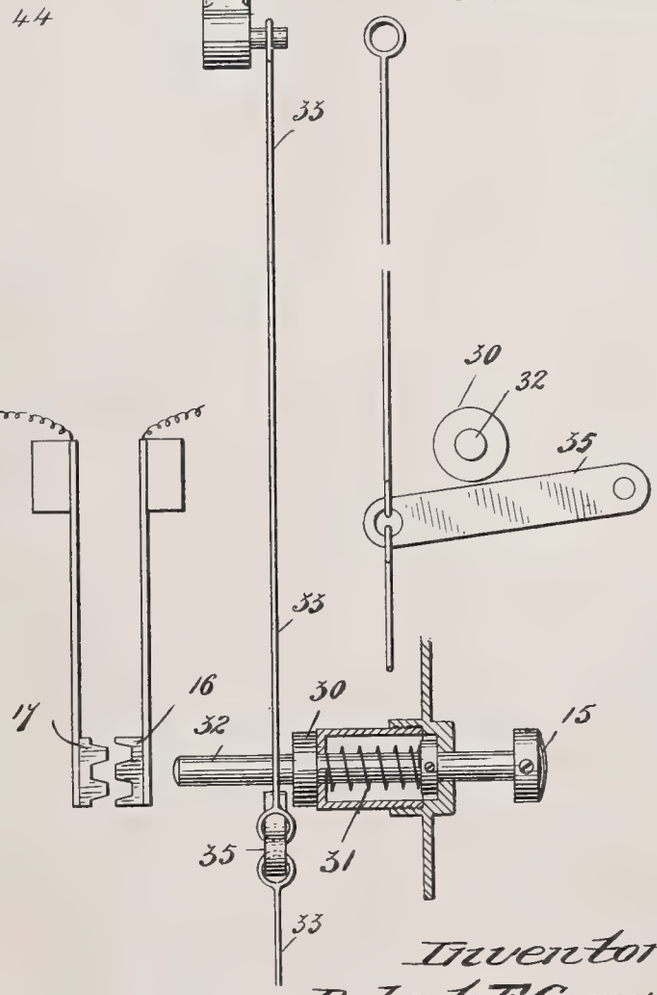


Fig. 7.



Inventor

Robert F. Carey

By

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Atty

THE NORRIS PETERS CO., WASHINGTON, D. C.

No. 747,317. PATENTED DEC. 15, 1903.

R. F. CAREY.

LIFT.

APPLICATION FILED JULY 13, 1903.

NO MODEL. 4 SHEETS—SHEET 4.

Fig. 9.

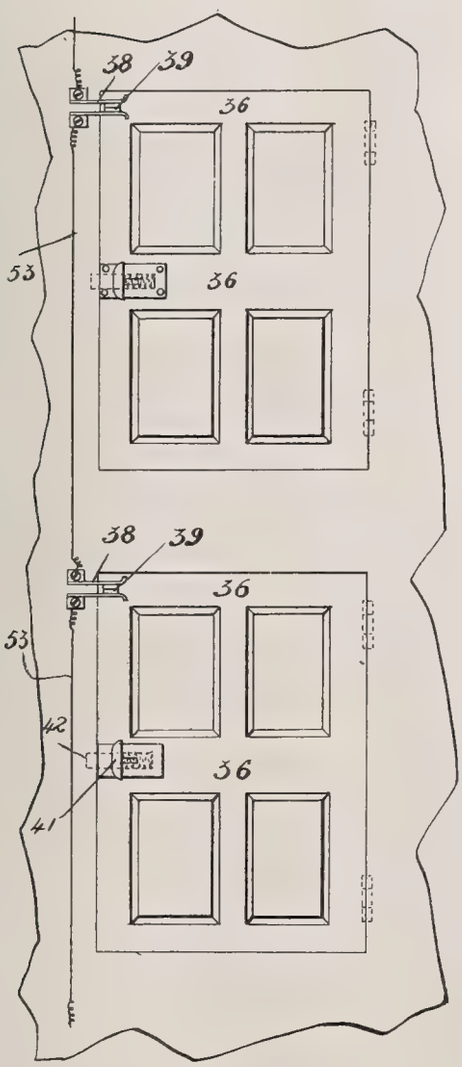

Fig. 10.

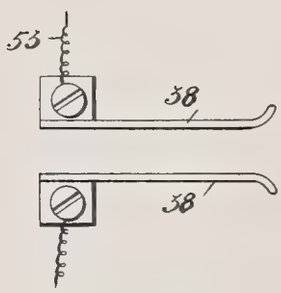

Fig. 11.

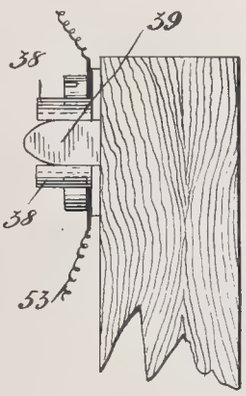

Fig. 12.

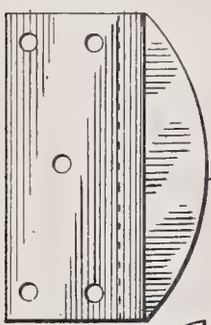

Fig. 14.

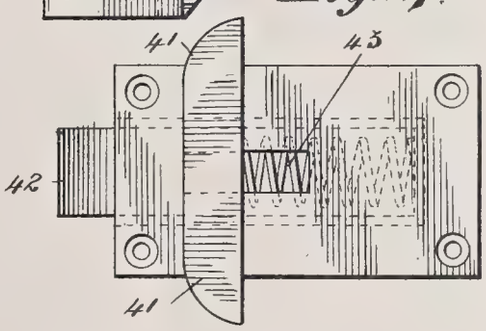

Fig. 15.

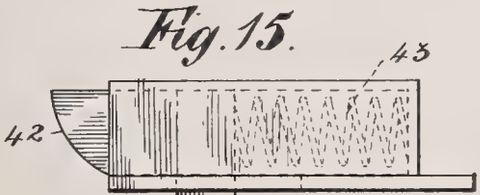

Fig. 13.

Witnesses:

J. B. Keller

James L. Norris, Jr.

Inventor

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By

James L. Norris

Atty.

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UNITED STATES PATENT OFFICE.

ROBERT FALKLAND CAREY, OF CRICKLEWOOD, ENGLAND, ASSIGNOR OF ONE-HALF TO JOSEPH RICHMOND AND COMPANY, LIMITED, OF HATTON GARDEN, LONDON, ENGLAND, A CORPORATION OF GREAT BRITAIN.

LIFT.

SPECIFICATION forming part of Letters Patent No. 747,317, dated December 15, 1903.

Application filed July 13, 1903. Serial No. 165,361. (No model.)

To all whom it may concern:

Be it known that I, ROBERT FALKLAND CAREY, a subject of the King of Great Britain, residing at 19 Ash Grove, Cricklewood, Middlesex, England, have invented certain new and useful Improvements in and Connected with Lifts, of which the following is a specification.

The object of this invention is to operate the mechanism of lifts by means of naked electric wires connected to and moving with the cage, the current being placed in or cut out of action automatically as the cage arrives at the position it is desired to be placed and being of the same or of a less power than that of the main supply.

The invention relates to that class of lifts which are operated by making electrical connection by a push-button—that is, each floor of a building and the cage are each in electrical connection with the controlling-gear of the lift—so that a person on, say, the ground floor and desiring to go by the lift to the third floor presses the third-floor push-button on getting into the lift, and the door being closed the electric current or other power will be established and the lift moved to the third floor, where it automatically stops by breaking the circuit, all other floors during the motion being cut out of the current, or a person on any floor wanting to use the lift pushes the button on the landing, and the lift automatically comes to him, up or down, as the case may be, and automatically stops and unlocks the door to admit him.

The invention will be clearly understood from the following description, aided by the accompanying drawings, in which—

Figure 1 is a diagram of a complete electric installation in which the electric power for controlling the movement of the lift-cage is less than that of the main supply, which actuates the lift-cage. Fig. 2 is a front elevation, partly in section. Fig. 3 is a side part section of two insulated blocks for connection to the lift-cage. Fig. 4 is a front elevation of the two insulated blocks with the contact in position when the cage is at rest and the current cut off. Fig. 5 is an elevation of a portion of the wire connected to the cage, showing the contact in position when the electric current is flowing and also showing the push-button contacts in connection. Fig. 6 is an elevation of a solenoid and its appurtenances for locking the push-buttons. Fig. 7 is a side view of one of the rods and levers for locking the push-button. Fig. 8 is an elevation of the solenoid and push-button employed in the cage, the solenoid controlling a rod and levers for locking the push-button. Fig. 9 is an inside elevation of two doors of a lift-well, showing the electrical connection and the door locked. Fig. 10 is a side view of the electrical contact for fixing in the lift-well wall. Fig. 11 is a view showing the contacts of the well-wall door connected. Fig. 12 is an elevation of a cam to be applied to a lift to actuate the locking device. Fig. 13 is a plan of same. Fig. 14 is an elevation of a locking device, and Fig. 15 a top view of the locking device.

For the purpose of this invention the same is described in connection with an electric lift, the current being of lower voltage than that of the main. Two naked wires 1 2 are connected to an insulating block or blocks 3 4 on the cage, and such wires 1 2 are passed over and under insulated pulleys 5 6, situated at the top and bottom of the lift-well 7, the free ends being connected to insulated blocks 8 9 and being held taut by a coiled spring 10, which also compensates for stretch of the wires 1 2.

Down the lift-shaft 7 at each floor 11 12 13 14 are arranged a series of push-buttons 15, these when being pressed pushing contact-pieces 16 against other contract-pieces 17 for establishing electrical connection with contact-pieces 18, which act on one or other of the wires 1 2, according to the position of cage 19, such contact-pieces 18 being electrically connected, so as to actuate a solenoid or armature of motor to move a switch. The electric current is conducted by a separate lead 20 from a battery or small motor-generator 21, connected to the main supply-wire 22 to a solenoid 23 in the cage 19, and thence by a wire 24 to a switch 25, and from the switch 25 by wires 26 27 to wipers 28 29, these having connection with

the wires 1 2 near the pulleys 5 6 on either side of the insulated pieces, so that on completion of the electric circuit one or other of the wires 1 2, connected to cage 19, becomes a live wire. Each push-button 15 is provided with a collar 30 (see Figs. 1 and 6) and is kept in its normal position by spring 31, and adjacent to the push-button stem 32 and in front of the collar 30 is a rod 33, actuated by a solenoid 34 in electrical connection with the motor-circuit, said rod 33 being connected to a lever 35, pivoted to the lift-well, so that on pressing in a button 15 the contacts 16 17 are connected to make electrical connection to the switch on the motor, which starts revolving and electrically connects the solenoid 34, which actuates each lever 35 either up or down to lock each push-button 15 and prevent movement of same from their normal position, the push-button 15 operated being also locked in the working position, the lever 35 being disposed on the inner side of the collar 30. In lieu of a lever the rod 33 may be provided with rings, which encircle the rods 32 for the same purpose, and instead of one solenoid operating the whole of the locking levers or rings each ring or lever may be actuated by a separate solenoid, or the rod or rods may be actuated by a governor appliance, so that the locking can be effected from the movement of the motor or lift. Thus it is impossible to tamper with the action of the lift through any push-button while being used.

The doors 36 of the lift-well on each floor are also electrically connected, so that when they are closed the electric current can be maintained; but the moment either is opened the electric current is broken and the cage cannot be moved until the door is closed. This is effected by running the negative wire 53 in proximity to each door 36 and breaking same at each door by contact-pieces 38, the connection being made by a plug 39, carried by the door, fitting between such contact-pieces 38 when the door is closed, as will be understood by reference to Figs. 9, 10, and 11. Each door is locked and unlocked, preferably automatically, in the ordinary manner when the cage 19 is at rest by providing the cage 19 with a cam-piece 40, Figs. 12 and 13, which acts against a projection-lug 41 of the door-lock, Figs. 14 and 15, to push the catch 42 back to release the door 36, the door on closing becoming fastened by the spring 43 moving the catch 42 out, when the cam 40 is removed from the abutment 41, due to the raising or lowering of the cage 19.

Push-buttons 44 are also arranged in the cage 19, and its locking-rod is in connection with a solenoid 23, so that the cage 19 can be operated from the cage to allow the cage to stop at any floor, the arrangements of push-buttons and locking device being the same as for the floors.

The lift is moved by the motor 46, which is switched in and out of action for rotation in the proper direction by the action of the push-buttons in establishing electrical connection according to which floor the cage is required to stop, and to effect this is the object of the two naked wires insulated from each other and moving with the cage. The wire 2, running from the bottom of the cage, is brought into electrical connection when it is desired to lower the cage, and the wire 1, running from the top of the cage, is brought into action when it is desired to lift the cage, the switch 25 controlling the direction of current for operating the motor in one or the other directions. The switch is electrically connected to the main on each side of the battery or motor, so that the main current can be directed to operate the motor 46 for moving the cage 19 and also for operating the solenoid 34 for locking the push-buttons 15.

Instead of having push-buttons in the car itself a hand-lever may be used to work the switch one way to go up and the other to come down and upon being released by the hand is automatically returned to the center position by a weight or spring, and thus stops the lift.

The insulating-blocks 3 4 (see Figs. 2, 3, and 4) are each affixed to a base 47, which is secured to the side of the car 19, and such bases 47 are provided with lugs 48, to which the wires 1 2 are secured, the bases being adjustable to determine the distance the insulating-blocks 3 4 are to be apart. Behind the lugs 48 I arrange a piece of carbon 49, and then I secure to the base the insulated blocks 3 4, so that perfect insulation is obtained. The degree of distance of the insulated blocks is for adjusting the cage as to position of rest at each floor.

Instead of solenoids being employed for operating the main switch one or two small motors may be employed, one to operate the main switch to send the lift up and the other to send the lift down.

By employing a current of small power to actuate the switch and locking devices no danger can result from persons touching the wires and, further, all sparking is prevented.

Referring to the diagram, the switch 25 is provided with two solenoids 50 51, which are connected to cross-arms of a pendulum 52, which pendulum when in the vertical position, as in full lines, is at rest, or, in other words, the switch 25 is cut off. Now supposing the lift is required to be lowered, a push-button on a floor below the lift is pressed, whereupon the current will pass through the solenoids 23 and 51 and through the contact 29 to the naked wire 2 and away by the contacts 18 and 17 on that floor to the negative main, the solenoid 51 being only attracted, because the solenoid 50 is not in circuit, due to there being no electrical connection with the naked wire 1; but when it is desired to raise the lift electrical connection with the naked wire 1 will cause the solenoid 50 to attract the pendulum, and so alter the switch.

The action is as follows: Suppose the lift-

cage 19 be in the position shown in Fig. 1 and some one on the floor 13 presses the button 15 on that floor. The current will flow through wire 20 from the battery or motor 21 through the solenoid 23, which raises or lowers its rod and locks all the push-buttons 44 in the cage, thence to the switch 25 and by reason of the connection by the push-button on floor 13, the circuit through that part, if open, so that the electric current will operate the switch for such current to pass through the solenoid 51 and wire 27, wiper 29, naked wire 2, through the contacts 18 and 17 to the negative main 53. The movement of the pendulum 52, attached to the switch 25, has placed the switch 25 for the current from the main 22 to pass by the wire 54 to the motor 46, so as to rotate same to lower the lift, the return-current passing by the wire 55 at the same time the solenoid 34 is actuated to lock the push-button 15. This movement of the cage continues until the insulating-pieces 4 on the cage 19 pass between the contacts 18 on the floor 13, when the current is broken. The pendulum 52 immediately returns the switch to the central position and stops the lift. The current no longer passing through the locking-solenoids 23 34, therefore all the buttons are released. Supposing instead of pressing the button on the floor 13 the button on floor 11 is pressed, the action then would be similar, except that the current would pass through the wires 24, solenoid 50, wire 26, wiper 28, naked wire 1, contacts 18 and 17 on floor 11. At the same time the current from 22 would pass to the switch 25 and thence through wire 55 to the motor 46 and back through 54 to the switch 25 and then to the chief negative main 56, the solenoid 34 being actuated to close the push-button 15. The lift continues to ascend until the insulating-piece is passed between the contacts 18 on floor 11, when, the current being broken, the pendulum 25 would return to its central position and the lift would come to rest. The action of the push-buttons in the car is similar. The current is taken to the contacts of whichever floor it is desired to reach through flexible wires and which are in connection with the buttons in the cage 19, each of which is marked with the number of the floor to which it is connected. If a door be opened at the moment the car is in front of a floor, (the door at this moment being, of course, unlocked,) the current is interrupted by the circuit-breaker and the lift comes to rest. In the unlikely event of two persons on different floors pushing buttons simultaneously the car will travel to the floor farthest from that at which the cage was at rest, when it will stop, unless the person at the intervening floor should stop the lift previously by opening the door as the car passes.

This system is equally applicable to a hydraulic lift, the only difference being the controlling-valve of the hydraulic system would be operated instead of the controlling-switch of the electric lift. The locking of the buttons on the floors would be effected by a small hydraulic cylinder.

What I claim, and desire to secure by Letters Patent, is—

1. In lifts the combination of two naked electric wires insulated from each other and connected to the cage and moving with same, means for establishing electrical connection between either wires and a negative main, and a switch to determine the direction of movement of the cage substantially as set forth.

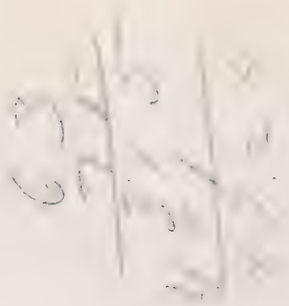
2. In lifts the combination of two naked electric wires each having one end connected to insulating-blocks on the cage, and after being passed over insulated rollers at the top and bottom of the lift-well, be connected together at their other end by insulating-pieces and a spring, a switch controlling the power for moving the lift, wipers against the naked electric wires connecting each with the switch and contact-pieces connecting the naked wires with the negative main, substantially as set forth.

3. In lifts the combination of two naked electric wires each having one end connected to insulating-blocks on the cage and after being passed over insulated rollers at the top and bottom of the lift, will be connected together at their other end by insulating-pieces and a spring, a switch controlling the power for moving the lift, wipers against the naked electric wires connecting each with the switch, contact-pieces connecting the naked wires with the negative main, and means for actuating the locking appliances of the contact devices, substantially as set forth.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ROBERT FALKLAND CAREY.

Witnesses:
RICHARD CORE GARDNER,
H. D. JAMESON.



No. 762,186. PATENTED JUNE 7, 1904.

J. S. MUCKLÉ.

LOCKING MECHANISM FOR ELECTRICALLY CONTROLLED ELEVATOR MECHANISMS.

APPLICATION FILED JULY 23, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

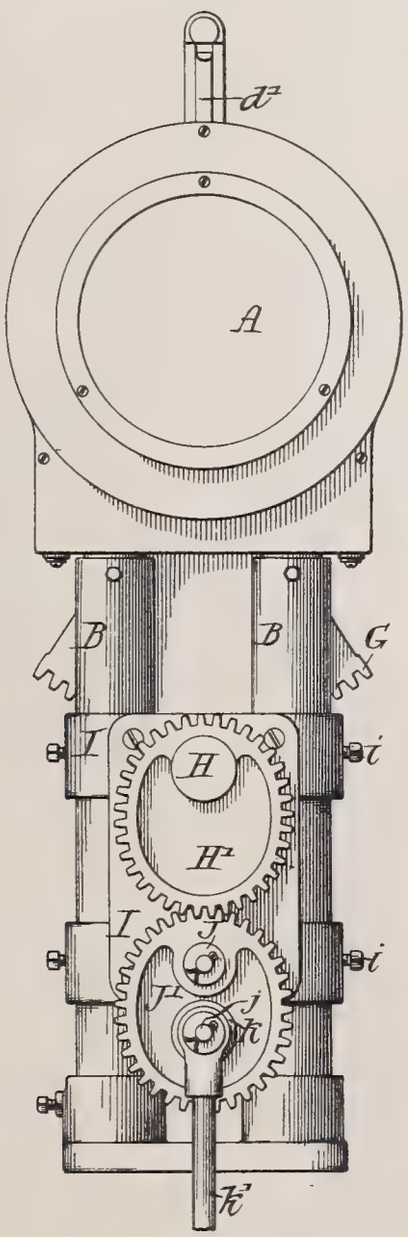
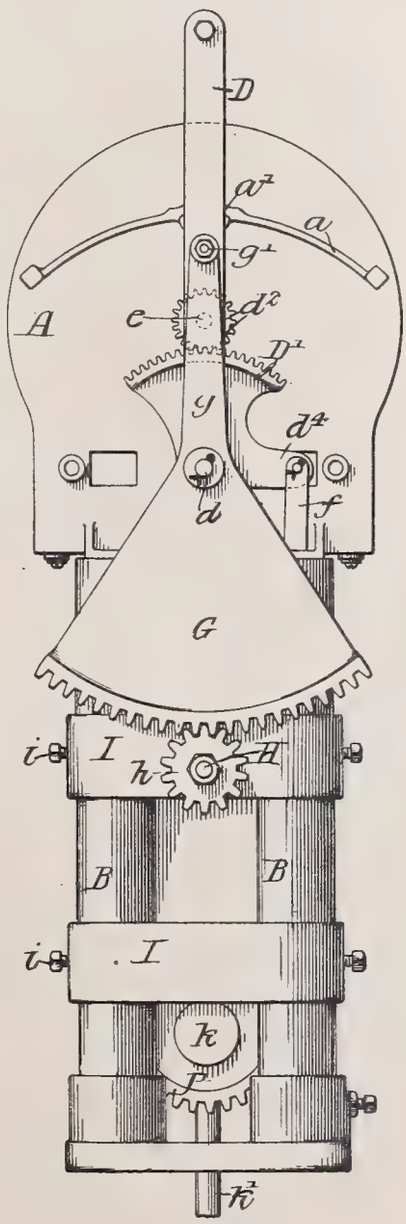


Fig. 2.



Witnesses:
Hamilton S. Turner
Frank L. A. Graham.

Inventor:
John S. Mucklé,
by his Attorneys;
Howson & Howson

THE NORRIS PETERS CO., WASHINGTON, D. C.

No. 762,186. PATENTED JUNE 7, 1904.

J. S. MUCKLÉ.

LOCKING MECHANISM FOR ELECTRICALLY CONTROLLED ELEVATOR MECHANISMS.

APPLICATION FILED JULY 23, 1903.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

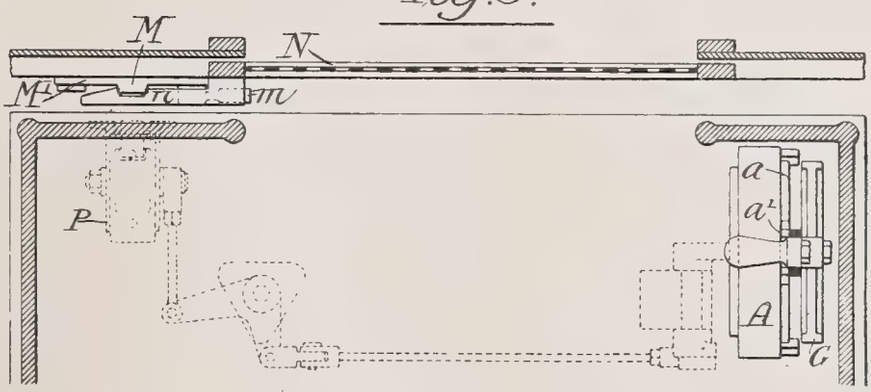


Fig. 5.

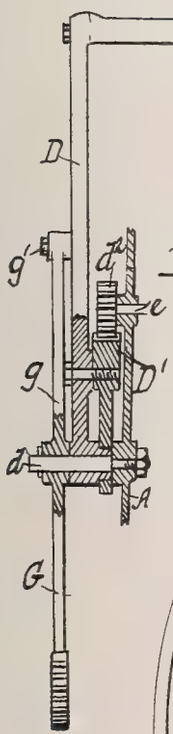
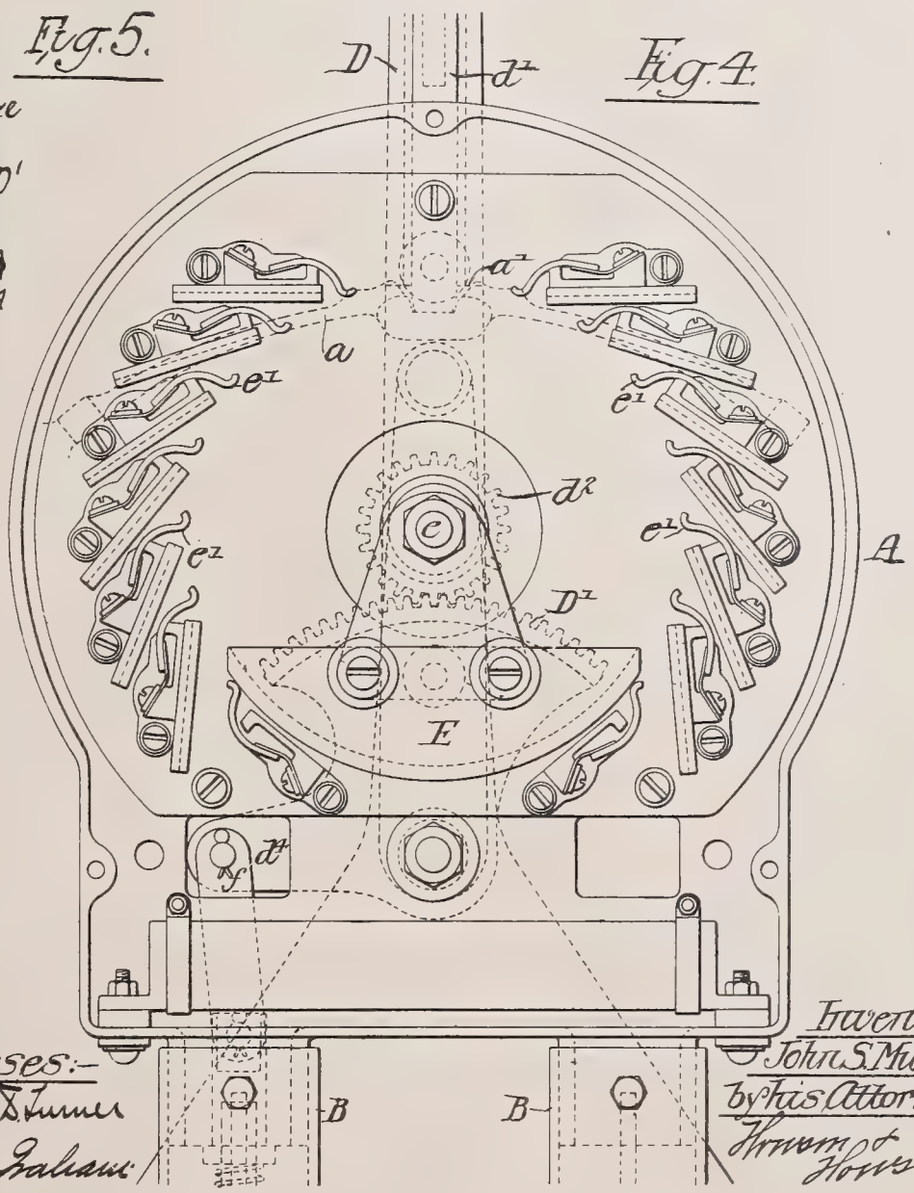


Fig. 4.



Witnesses:-
Hamilton D. Turner
Frank La Galiana

Inventor:-
John S. Mucklé,
by his Attorneys;
Brown & Howson

THE NORRIS PETERS CO., WASHINGTON, D. C

No. 762,186. Patented June 7, 1904.

UNITED STATES PATENT OFFICE.

JOHN S. MUCKLÉ, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO STANDARD ELEVATOR INTERLOCK COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

LOCKING MECHANISM FOR ELECTRICALLY-CONTROLLED ELEVATOR MECHANISMS.

SPECIFICATION forming part of Letters Patent No. 762,186, dated June 7, 1904.

Application filed July 23, 1903. Serial No. 166,698. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. MUCKLÉ, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Locking Mechanism for Electrically-Controlled Elevator Mechanism, of which the following is a specification.

My invention relates to certain improvements in elevators in which an operating-lever is used to govern the movement of the car.

The main object of my invention is to combine with this electric mechanism means by which the landing-doors are allowed to be opened when the car is at a landing and for locking the car at the landing when the door is open. This object I attain in the following manner, reference being had to the accompanying drawings, in which—

Figure 1 is a front view of an elevator-car electric controller, showing my improvement. Fig. 2 is a rear view of Fig. 1. Fig. 3 is a plan view of an elevator-car, showing the connection between the mechanism shown in Fig. 1 and the door-locking mechanism. Fig. 4 is a view of the controller with the face of the casing removed. Fig. 5 is a detached view of the operating-lever and segment.

Referring to the drawings, A is the casing of an electric controller for starting and stopping the elevator-car. This controller-casing is mounted on two pedestals B B. On the rear of the casing A is a segment *a*, having a central recess *a'*.

D is a lever pivoted at *d* to the casing. This lever has a locking-bolt *d'*, which is arranged to drop into the notch *a'* when the lever is in a central position. The lever is moved in one direction from the central position to shift the mechanism to raise the car and is moved in the opposite direction to lower the car.

Secured to the lever D is a segmental rack , meshing with a pinion d^2 on the shaft *c*, carrying a segmental contact E, which is arranged to travel over the permanent contacts *e'* on the casing. Attached to an arm d^4 of the segment D' is a link *f*, connected to a plunger in one of the tubular pedestals, forming a dash-pot.

The above-described mechanism forms no part of my present invention, as it is simply one form of electric controlling mechanism for elevators.

G is a segment pivoted at *d* and attached by its arm *g* to the lever D at *g'* in the present instance, and in some cases this segment G may be made integral with the lever D. The teeth of this segment mesh with a pinion *h* on the shaft H, which is mounted in bearings on the frame I, secured to the pedestals B in the present instance by set-screws *i*. On this shaft H is an elliptical gear-wheel H', which meshes with an elliptical gear-wheel J' on a stud J. Attached to the pin *j* on this elliptical gear-wheel is a head *k* of a rod *k'*, leading to the lock mechanism. (Clearly shown in Fig. 3.) The locking mechanism consists in the present instance of a spring-lever M, pivoted to a plate M', secured to the elevator-well. This lever engages a latch *n* on the door N at the landing, and on this plate is a lever *m*, controlled by the door which locks the plunger P, which is mounted on the car and connected to the controlling mechanism above described by a series of levers and rods. (Shown by dotted lines.) When the car is at a landing and the door is open, the lever *m* locks the plunger P to prevent the operating-lever D being moved; but as soon as the door is closed by the operator it will shift the lever, release the plunger, and allow the operating-lever to be moved. The moment the door is closed and the car leaves the landing the spring-lever M locks the door, preventing it being opened when the car is not at a landing.

I claim as my invention—

1. The combination of an electric controlling mechanism for elevators, a lever for shifting the controlling mechanism, a segment thereon, a shaft, a pinion on the shaft meshing with the teeth of the segment, an elliptical gear on the shaft, a second elliptical gear meshing with the first-mentioned elliptical

gear, locking mechanism on the elevator-car connected to the last-mentioned elliptical gear, and locking mechanism on the elevator-well for locking the gear when the car is at a landing and the door is open, substantially as described.

2. The combination of an elevator-car, pedestals mounted on the car, a controller-frame carried by the pedestals, electric controlling mechanism therein, an operating-lever for shifting the controlling mechanism, a segment on said lever, a frame on the pedestals, a shaft mounted in bearings on the frame, a pinion mounted on the shaft and meshing with the segment of the operating-lever, an elliptical gear carried by the shaft, a second elliptical gear meshing with the first-mentioned elliptical gear and carried by a stud on the frame, a head pivoted to the last-mentioned elliptical gear, a plunger connected to said head, an elevator landing-door, means for locking the door, and means on the elevator-well for locking the plunger when the car is at a landing, substantially as described.

3. The combination of controlling mechanism for elevators, a lever for shifting the controlling mechanism, a segment thereon, a shaft, a pinion on the shaft meshing with the teeth of the segment, an elliptical gear on the shaft, a second elliptical gear meshing with the first-mentioned elliptical gear, locking mechanism on the elevator-car connected to the last-mentioned elliptical gear, and locking mechanism on the elevator-well for locking the gear when the car is at a landing and the door is open, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN S. MUCKLÉ.

Witnesses:
WILL. A. BARR,
JOS. H. KLEIN.

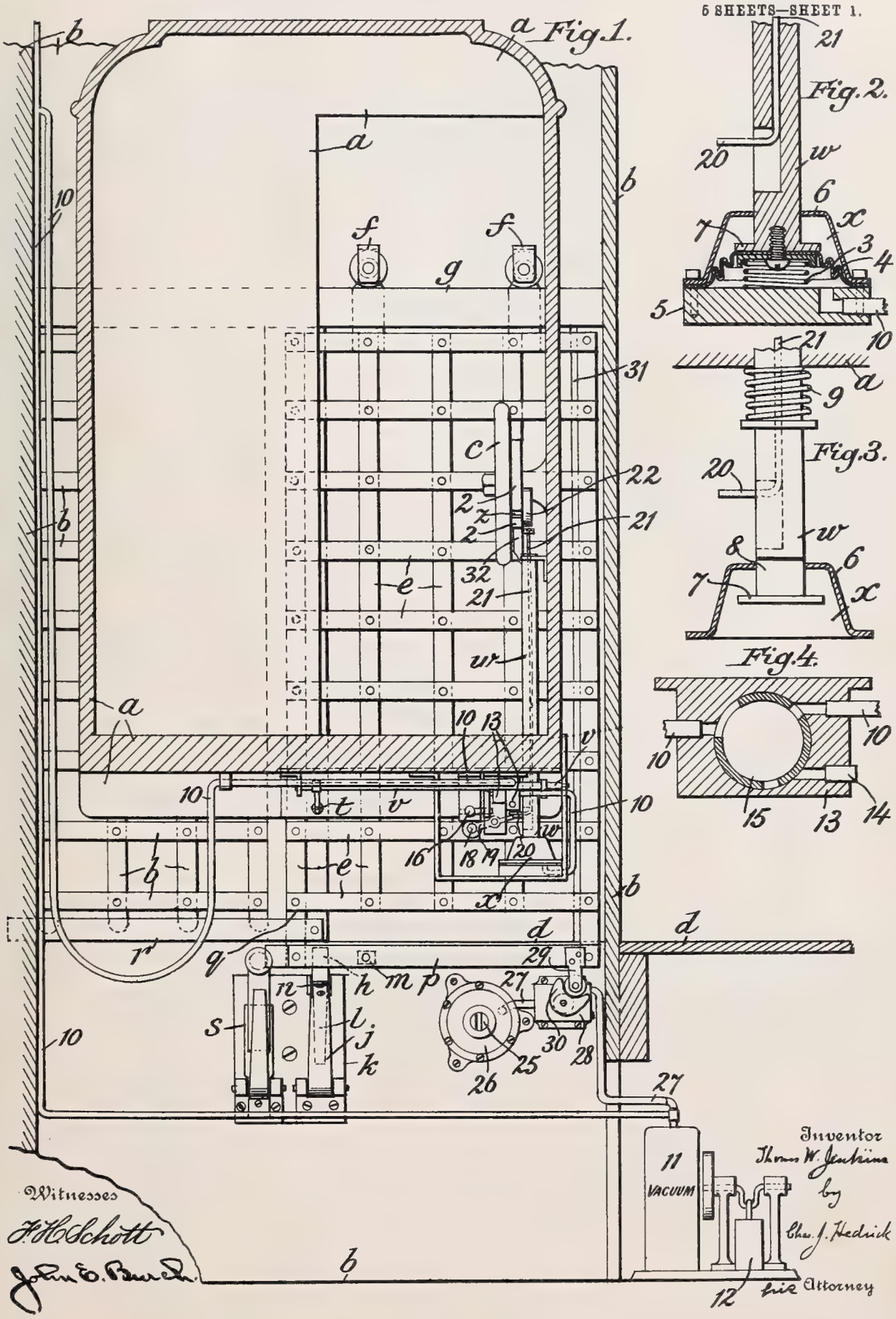
No. 783,205. PATENTED FEB. 21, 1905.

T. W. JENKINS.

SAFETY DEVICE FOR ELEVATORS.

APPLICATION FILED FEB. 4, 1904.

5 SHEETS—SHEET 1.



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5 SHEETS—SHEET 2.

Fig. 5.

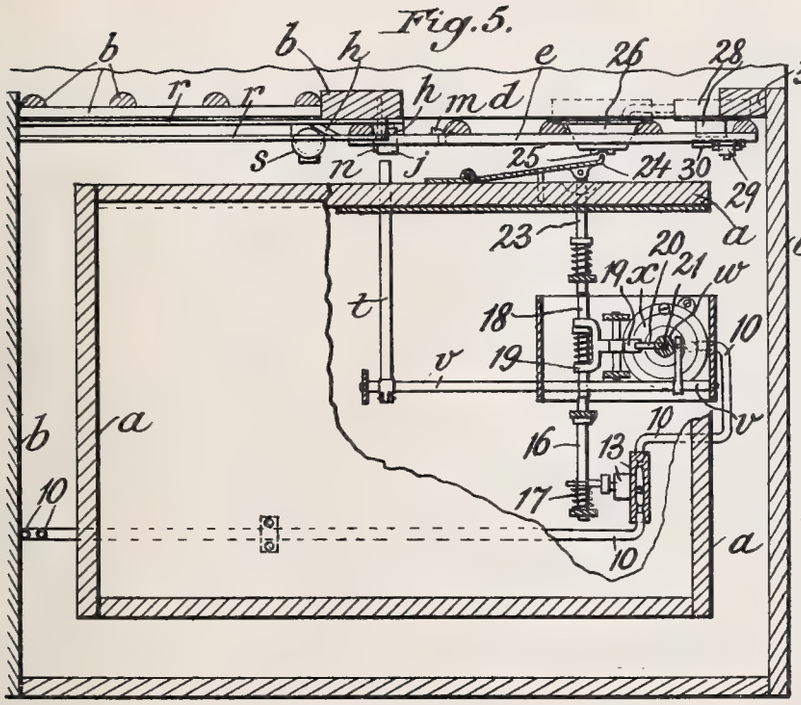


Fig. 7.

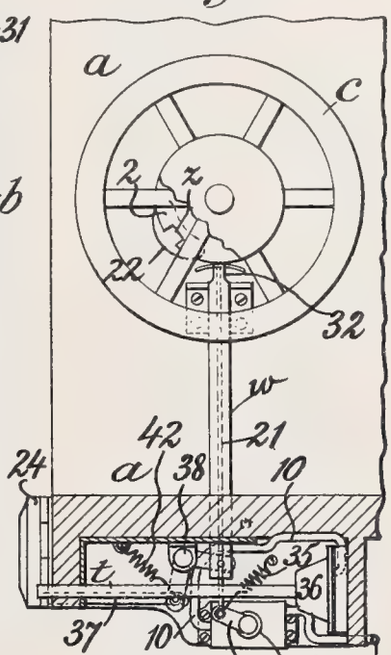
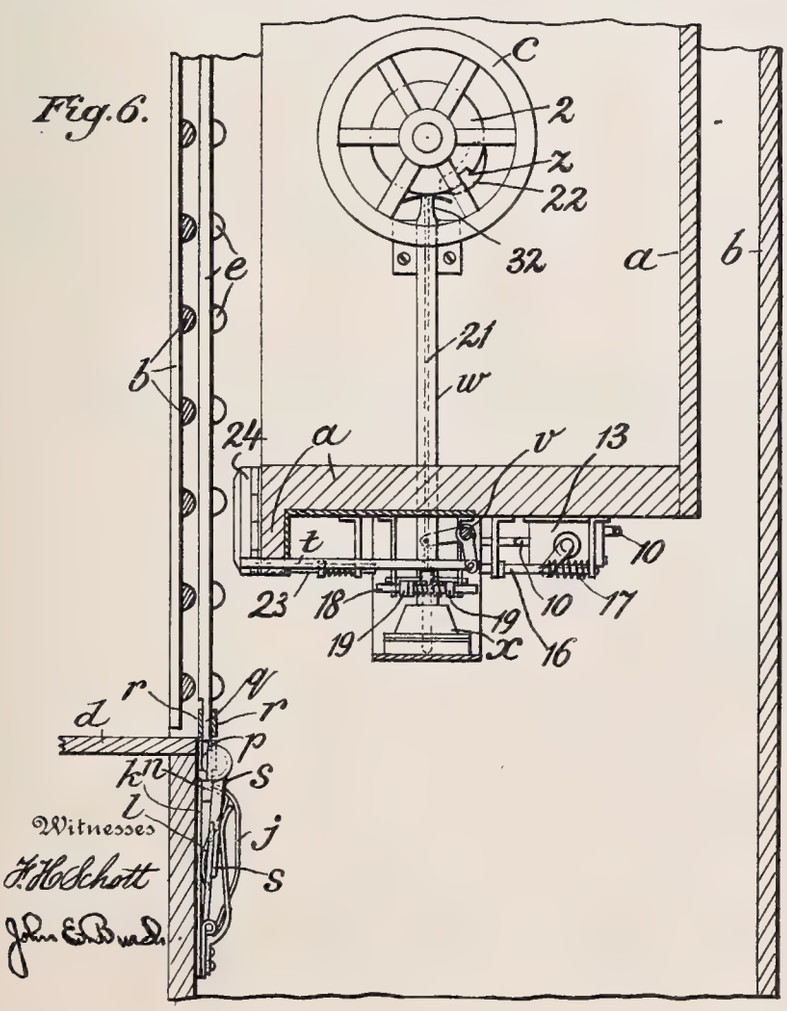


Fig. 8.

Fig. 6.

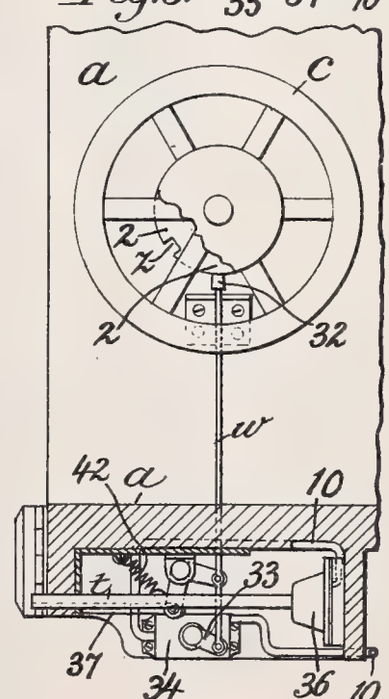


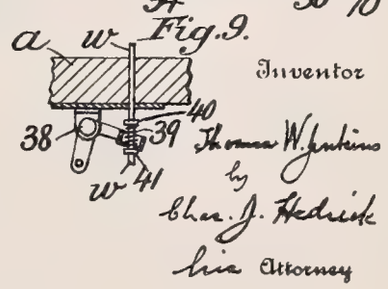
Witnesses

H. H. Schott

John E. Bruch

Fig. 9.





Inventor

Thomas W. Jenkins

by

Chas. J. Hedrick

his Attorney

No. 783,205. PATENTED FEB. 21, 1905.

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SAFETY DEVICE FOR ELEVATORS.

APPLICATION FILED FEB. 4, 1904.

5 SHEETS—SHEET 3

Fig. 10.

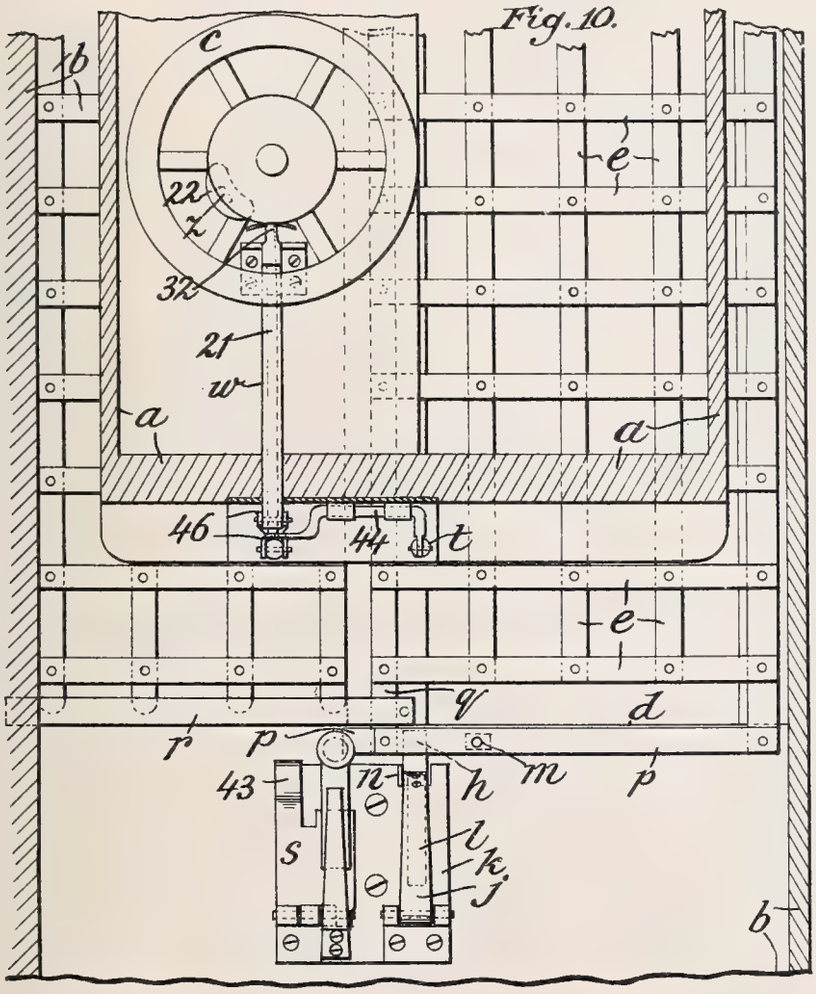


Fig. 12.

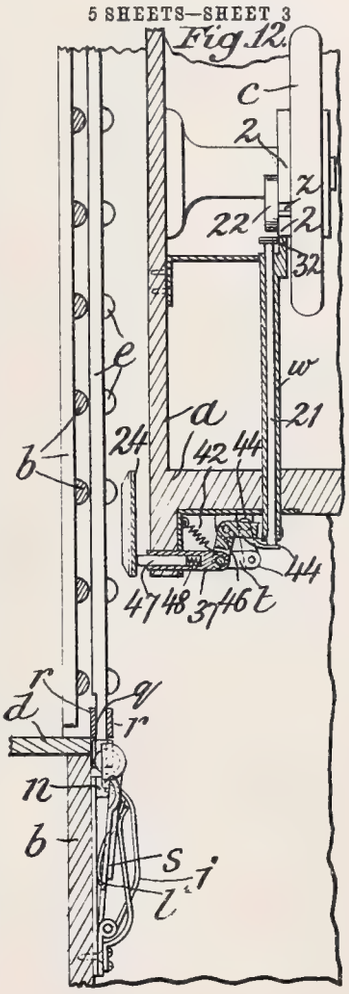


Fig. 11.

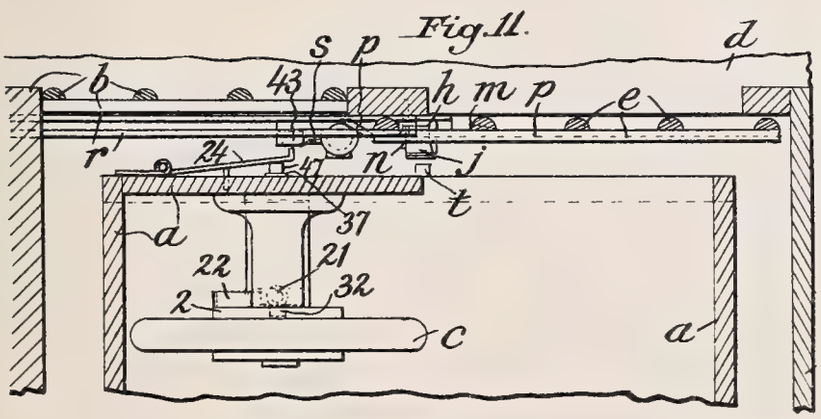
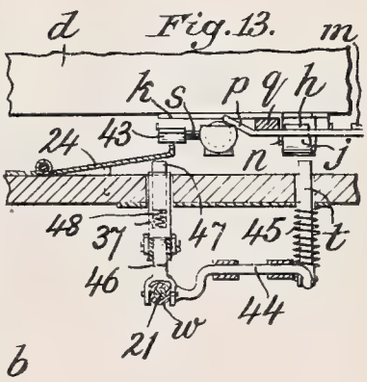


Fig. 13.



Witnesses

F. H. Schott

John E. Burch

Inventor

Thomas W. Jenkins

By Chas. J. Hedrick his Attorney

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5 SHEETS—SHEET 4.

Fig. 14.

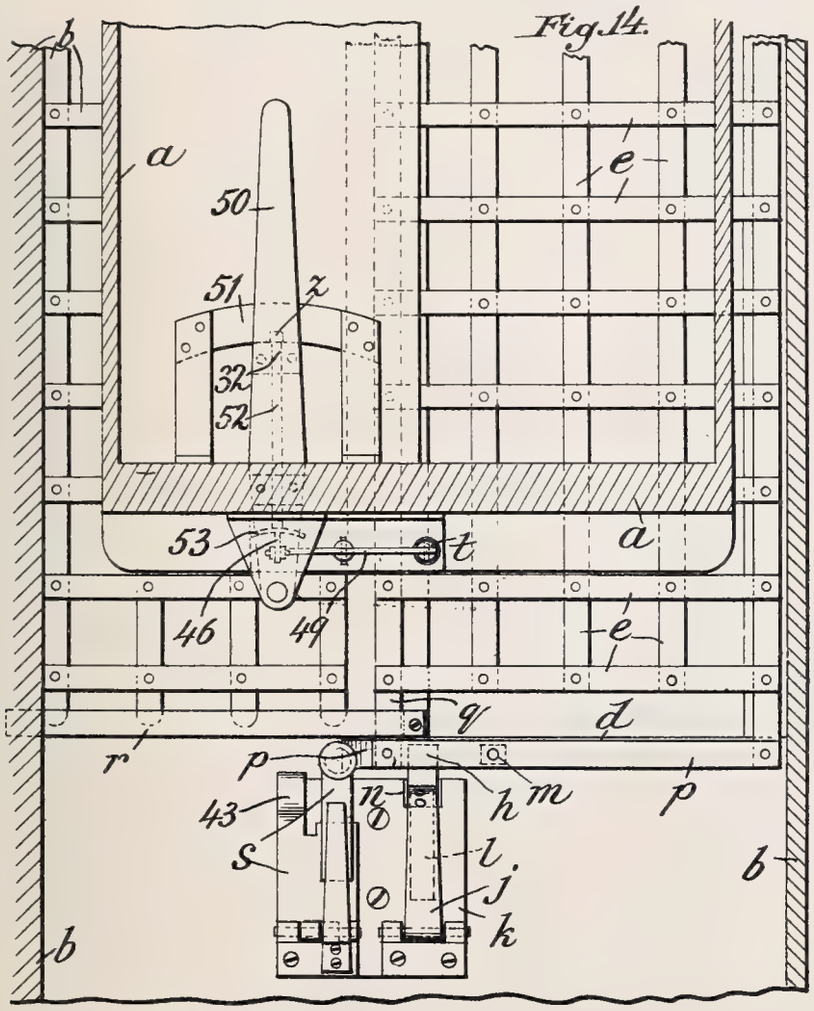


Fig. 16.

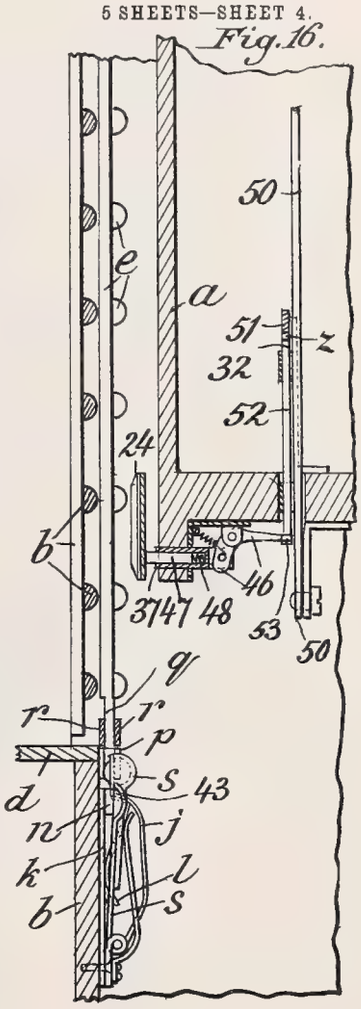


Fig. 15.

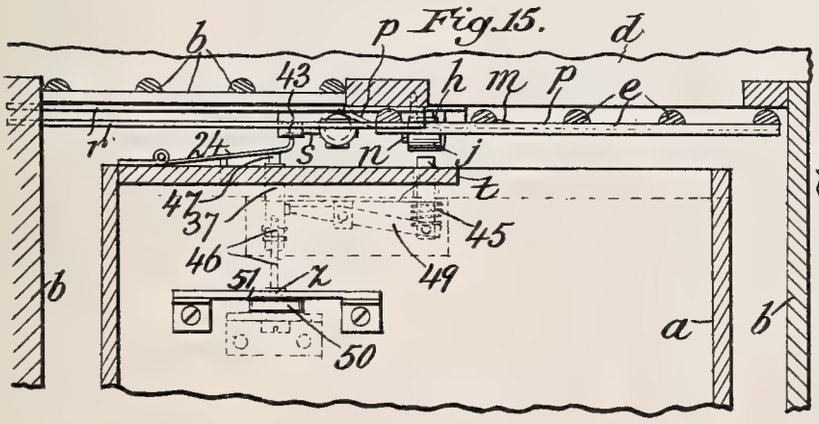
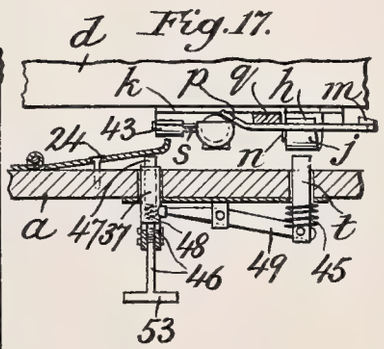


Fig. 17.



Witnesses

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No. 783,205. PATENTED FEB. 21, 1905.

T. W. JENKINS.

SAFETY DEVICE FOR ELEVATORS.

APPLICATION FILED FEB. 4, 1904.

5 SHEETS—SHEET 5.

Fig. 18.

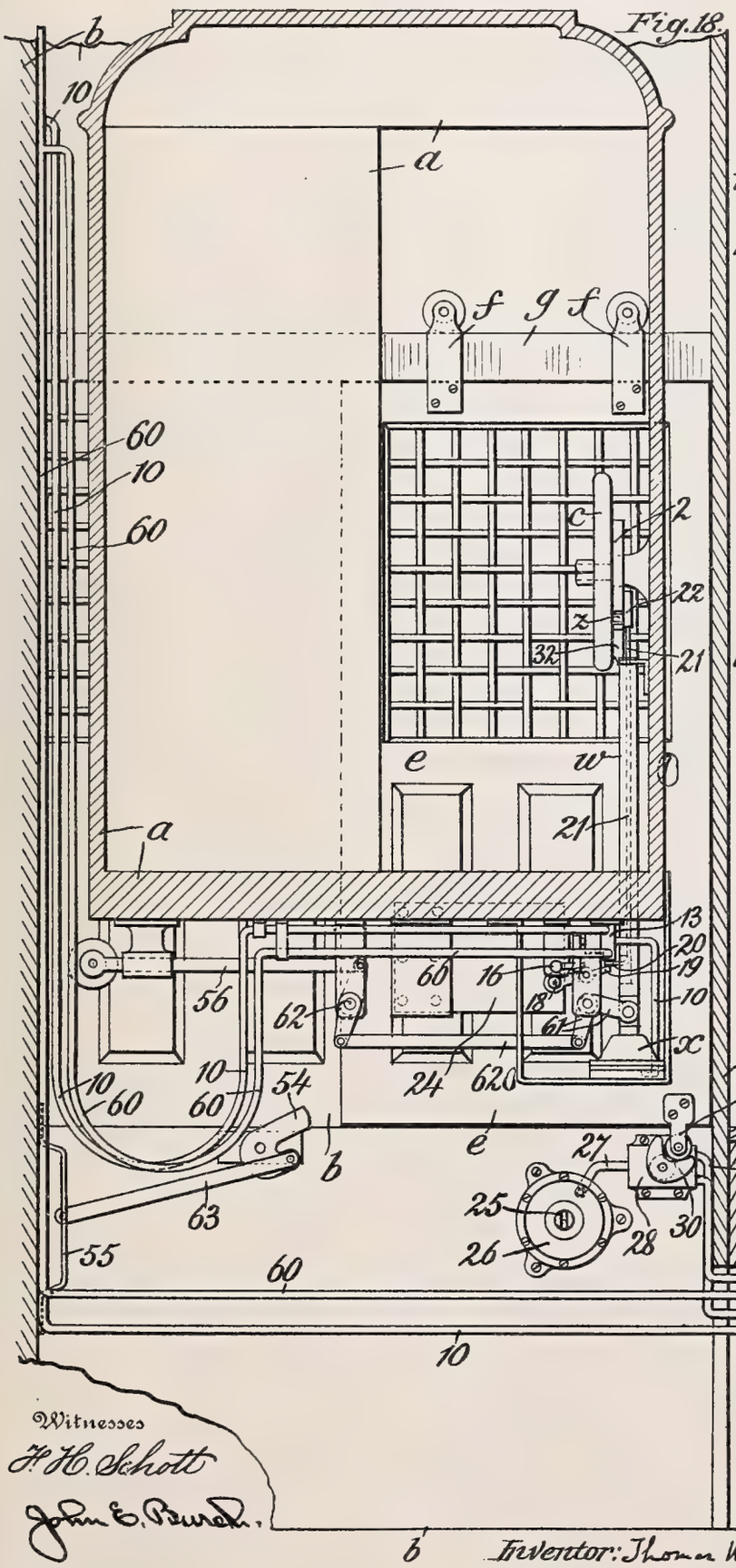


Fig. 19.

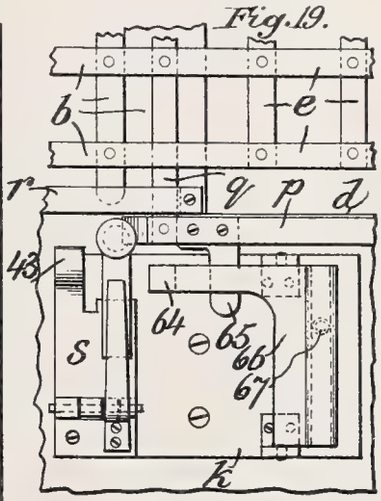
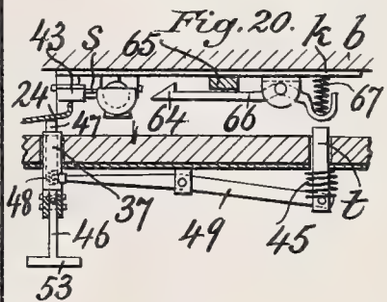


Fig. 20.



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No. 783,205. Patented February 21, 1905.

UNITED STATES PATENT OFFICE.

THOMAS W. JENKINS, OF PHILADELPHIA, PENNSYLVANIA.

SAFETY DEVICE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 783,205, dated February 21, 1905.

Application filed February 4, 1904. Serial No. 191,931.

To all whom it may concern:

Be it known that I, THOMAS W. JENKINS, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented new and useful Improvements in Safety Devices for Elevators, of which the following is a specification.

This invention relates more particularly to apparatus for increasing the safety of travel on passenger-elevators in one or more of the following ways—that is to say: first, by making the unlatching of a door on the elevator-car or at a landing dependent upon the presence of the car at a landing; second, by making the opening of a door dependent upon the position of the controller by which the car is stopped and started; third, by locking the controller when a door is opened; fourth, by making the operation of the controller dependent upon the closure of a door. Some of the parts, improvements, or combinations composing the invention may, however, be found useful in other relations in or outside of elevators, and each of them is intended to be secured for all the uses to which it may be adapted with or without modification.

It is more important ordinarily that a landing-door rather than a door on the elevator-car should have its opening and closure guarded, and in the following description a landing-door only will be referred to, leaving it to be understood that it is intended to cover the application of the same or substantially similar mechanism to a car-door or a landing-door and a car-door with the necessary transpositions and additions, which, in view of the said description and the prior state of the art, will be sufficiently obvious to the skilled reader. The door may be opened and closed manually or pneumatically or through any form of power; but it will suffice to describe the invention in connection with a manually-operated door, which is the most common arrangement. From such description the application of the new or improved safety devices to doors opening and closing by other power will be sufficiently obvious.

By the term "latch" herein is intended a device which in one position prevents and in another permits a door to be opened. The term includes, therefore, such a device as a valve for controlling the flow of compressed air into the cylinder of a pneumatic door-opening mechanism. It will suffice to exhibit the latch as a removable stop in the path of the door or of a device moving with the door. Such form of latch is that which it is expected to employ, although, as just indicated, other forms are not excluded. The term "lock" is applied to a device which in one position prevents and in another permits the movement of the controller to start and stop the car. It can be varied greatly as to its form, construction, and arrangement. In fact, various forms are known. It will suffice to exhibit it in the form of a dog engaging a lever or wheel on the car, the same being probably in most cases the best of the known forms of controller-lock. The words "latch" and "lock" are in themselves so similar in meaning that either of them might be applied to the device for preventing or permitting the movement indifferently of the door or the controller; but for greater precision the terms "latch," "latching," "unlatching," and the like will be employed in this specification with reference to the door only and not to the controller, while the terms "lock," "locking," "unlocking," and the like will be applied to the controller only and not to the door. The term "controller" is applied only to mechanism through which the movement of the car is stopped and started. The term "gap" signifies the space or clearance which necessarily exists between the elevator-car and the elevator-shaft, and which may vary in width in different elevators or at different times and with different loadings in the same elevator.

In accordance with the present invention a latch and a lock are combined with operating mechanism which is composed of two or more sets of coöperating pieces, each set including a reciprocatory cam-shaped piece on one side the gap and a coöperating piece on the other and being governed in common with the other set by one or more of the movable appliances manipulated in running the elevator—namely, by the door or by the controller or by the joint action of the door and the controller. By this

system interdependence of operation is secured in a manner not to distract the attention of the attendant from his duty of running the car, while proper working of the safety devices is allowed notwithstanding that a door should accidentally be left open. It will be understood that governance by movable appliances common to both sets of coöperating reciprocatory devices does not exclude the use of a governing appliance peculiar to one set if there is also an appliance common to both. In fact, in some of the hereinafter-described forms of the new or improved safety devices the lock is governed by the joint action of the door and the controller, while the latch in such forms is governed by the controller only. In others the lock and latch are both governed by the joint action of the door and the controller and other arrangements are not excluded. Also in accordance with the invention lock-operating and latch-operating mechanism is employed which includes two horizontally-reciprocatory pieces each movable transversely to the door's movement in cooperation with a piece on the other side of the gap and each operatively connected below the car-floor with the lower end of an upright vertically-movable bar. There may be upright vertically-movable bars appropriate to the said horizontally-reciprocatory pieces, respectively, or the latter may be connected with the same bar or bars. Both forms of the invention are hereinafter described. It is an additional advantage and special improvement to operate the latch by the aid of a rock-shaft mounted under the car-floor parallel with the door's movement and connected with the corresponding reciprocatory piece and upright bar. This piece might be an arm of the rock-shaft; but it is best constituted by a separate piece, which is joined to such arm and reciprocates in a straight or approximately straight line. Moreover, this disposition of rock-shaft could be used otherwise than in connection with the upright bar without exceeding the limits of the invention.

While the use of two horizontally-reciprocatory pieces movable transversely to the door's movement, as aforesaid, and the use of a latch-operating rock-shaft parallel to the door's movement are improvements and are one or both made essential in appropriate clauses of claim, neither of them is essential to other clauses, and one form of the new or improved safety devices is hereinafter described, (with reference to Figure 18,) in which a transversely-disposed latch-operating rock-shaft is employed and in which also there is only one horizontally-reciprocatory piece movable transversely to the door's movement in coöperation with a piece on the other side of the gap, the horizontally-reciprocatory piece which acts across the gap to operate the latch being movable parallel with the door's movement. Further, in accordance with the invention a lock (with or without a latch) and a controller which resists locking unless in mid-position are combined with lock-operating mechanism which includes both a reciprocatory cam-shaped piece operating across the gap and a yielding means of connection through which the locking motion is transmitted. If, therefore, a door should by any chance be left open, the said cam-shaped piece will automatically be brought into action when the car reaches the corresponding landing, and if the controller should not be in mid-position there would be danger of breakage were it not for the yielding connection. This is sufficiently stiff to transmit the locking motion; but it yields before breakage can occur. Still further, in accordance with the invention use is made of one or more stored-power motors for operating the latch through mechanism which acts across the gap and which is more particularly although not exclusively such as hereinbefore set forth. Such use of stored power is believed to be new broadly. The stored power may be that of a normally retracted spring, or it may be fluid-pressure, or it may be other form of force. The use of stored power has several advantages, especially when the latch-operating mechanism is governed by the movable appliances (namely, the door and controller, either or both) which have to be manipulated in running the elevator, because only a limited movement of these appliances can be allowed for such governance and because, further, the effectiveness of this limited movement is liable to be further diminished by variations in the horizontal distance between the car and the landing. It might be supposed that this distance would be constant; but, in fact, it varies sufficiently to make difficulty. The crowding together of passengers near the doorway of the car is liable, especially when the load is heavy, to swing the car somewhat away from the landing. The use of a stored-power motor is also advantageous in largely or wholly avoiding detrimental lost motion in the latch-operating mechanism, and still other advantages attend or may attend its use. Stored power can also be used to actuate the lock-operating mechanism. This latter application of stored power is not so broadly new as is the application thereof to unlatching; but the invention includes, broadly, the combination of a stored-power motor with lock-operating mechanism which both acts across the gap and is controlled by the joint action of the door and the controller. A stored-power motor in either connection is not essential to all the claims, and the new and improved safety devices are hereinafter described in some forms with and in others without a stored-power motor or motors.

The invention also comprises all and several the hereinafter-specified parts, improvements, and combinations.

The devices, with their operating mechanism and governing appliances, may be modified indefinitely, so long as the substance of any one or more of the hereinafter-written claims is taken.

In the accompanying drawings, which form part of this specification, Fig. 1 is a view in vertical section and elevation of an elevator provided with the new or improved safety devices in a form in which the latch-operating and lock-operating mechanisms are each governed by the joint action of the door and the controller through two stored motors, one on the elevator-shaft and one on the car, the view being in a plane parallel with that of the landing-door and being taken inside the car looking toward the landing-door with the car-floor above the landing-floor. Fig. 2 is a detail view in section of the stored-power motor connected with one of the upright vertically-movable bars. Fig. 3 is a view of a modification in the connection between the said motor and the upright vertically-movable bar. Fig. 4 is a detail view in section of the valve for said stored-power motor. Figs. 5 and 6 are views in plan and horizontal section and in elevation and vertical section, respectively, of the elevator of Fig. 1, the vertical section being in a plane at right angles to that of Fig. 1. Figs. 7 and 8 are views illustrating other forms of the new and improved safety devices operating by the aid of a stored-power motor. Fig. 9 is a detail view showing a form of yielding connection applicable to the mechanisms of Figs. 7 and 8. Figs. 10, 11, and 12 are views corresponding with Figs. 1, 5, and 6, respectively, of a form of the new and improved safety devices operating without the aid of a stored-power motor. Fig. 13 is a view in plan and horizontal section below the plane of Fig. 11. Figs. 14, 15, and 16 are views corresponding with Figs. 1, 5, and 6, respectively, of another form operating without the aid of a stored-power motor. Fig. 17 is a view of the same corresponding with Fig. 13. Fig. 18 is a view corresponding with Fig. 1 of another form of the safety devices operating with the aid of stored-power motors; and Figs. 19 and 20 are views in elevation and in horizontal section, respectively, of a form of latch which without further changes can replace that of Figs. 1, 5, and 6, 12, 13, and 14 to 17.

Referring to Figs. 1 to 6, the car *a* travels vertically in the elevator-shaft *b* in any ordinary or suitable way. It is stopped and started by suitable controlling mechanism, which is represented by the wheel *c*, herein referred to as the "controller." Such a wheel is a common appliance in elevators. When turned in one direction from its mid-position, it starts the car *a* upward. When turned therefrom in the other direction, it starts the car downward, and when in mid-position it stops the car. Ordinarily the stoppages would be made at a landing, as *d*, where there is a door *e* in the elevator-shaft *b* to permit or to prevent the entrance and exit of passengers, according as the door may be open or closed. The door is shown as a "sliding" door (as commonly called) which moves in its own plane and is suspended by hangers *f*, which have rollers running on the stationary track *g*, as customary in elevators. The door when closed is held by means of a latch *h*, formed, as shown, by the upper end of a cam-shaped reciprocatory piece *j*, hinged at its lower end to a base-plate *k* on the wall of the elevator-shaft and pressed outward from said wall by a spring *l*. The latch *h* constitutes a movable stop in the path of the device *m*, which moves with the door. The latch and the reciprocatory piece which carries it move transversely to the movement of the door. To aid in supporting the latch against an attempt to open the door when latched, a lateral bearing *n* is provided for the reciprocatory piece *j*. When the latch *h* is removed from the path of the device *m* by pressing the piece *j* towards the supporting-wall, the door is free to be opened by moving it to the left in Fig. 1. The device *m* is carried by a horizontal bar *p*, which is fastened to the door by suspension-bars at the front and rear edges, respectively, of the door. The bar *q* at the rear edge of the door moves between supporting-plates *r*. The latter form a new or improved means for holding and guiding the door at the bottom. The horizontal bar *p* has its left-hand end bent (see Fig. 13 also) to form an incline or cam which acts upon and is acted upon by a spring-pressed plate *s*, hinged at the bottom to the base-plate *k* and provided at the top with an antifriction-roller, shown as a ball turning in a socket on the plate *s*. When the door is moved to the left, the incline or cam-face of the bar *p* during the first part of the door's movement forces the plate *s* away from the supporting-wall transversely to the door's movement. When the door is moved to the right, the pressure of the roller of plate *s* against the cam-bar *p* tends to move the door during the latter part of its motion, and if it should be not quite closed the said pressure would complete the closure. For operating the latch there is on the car *a* a reciprocatory piece *t*, which acts across the gap. It is moved out in order to withdraw the latch *h* from the path of the device *m*, and it is moved in in order to leave the latch free to place itself in the path of device *m*. Should the piece *t* be moved out before the car arrives at a landing, the cam shape of the coöperating reciprocatory piece *j* on the other side of the gap would enable it to operate to displace the latch *h* from the path of the device *m*. The reciprocatory piece *t* is connected with an arm of the rock-shaft *v*, mounted under the car-floor parallel with the movement of the door *e*. Another arm of the rock-shaft *v* is connected with the

lower end of an upright vertically-movable bar *w*, which is lifted on occasion by the aid of a stored-power motor *x*, provided the controller *c* is in mid-position. When it is in mid-position, a notch or cut-away portion *z* in a stop device or disk 2 on the controller lies directly over the upper end of the upright bar *w* and is adapted to receive the same. In other positions the stop device 2 resists the rise of the bar *w*, and consequently also the motion of rock-shaft *v* and reciprocatory piece *t*. The stored power of the motor *x*, as shown, (see Fig. 2) is that of a normally retracted spring 3. When this is allowed to act, it tends to raise bar *w*. It is held retracted by a vacuum in the collapsing-chamber below the bar. One wall of this chamber is formed of a flexible sheet 4. It may be of india-rubber, which is fastened at the center to the lower end of the bar *w* and at the edges to the base-plate 5. When the air is withdrawn from the chamber, the bar *w* is forced down against the pressure of the motor-spring 3. To protect the sheet 4 of the collapsing-chamber, it is placed under the metal cap 6, and there is a flange or plate 7 on the lower end of the bar *w* of greater diameter than the hole in the cap 6. In Fig. 3 the bar *w* is separate from the plate 7, which has a pin 8, which projects through the hole in the cap 6. A light spring 9 tends to hold down the bar *w*, although the weight of the bar might suffice by itself. For withdrawing the air from the collapsing-chamber there is a pipe connection 10 between the same and the cylinder 11, in which a vacuum is constantly maintained by the exhaust-pump 12. A portion of this pipe connection is flexible to allow the end which is attached thereto to rise and fall with the car. Included in the pipe connection on the car is a three-way valve 13, (see Fig. 4,) two of the ways being part of the pipe connection 10 and the third way 14 being open to the atmosphere. The valve-plug 15 is normally in the position shown in Fig. 4, which establishes communication between the collapsing-chamber of the stored-power motor *x* and the vacuum-cylinder 11. When it is turned, it opens communication between the collapsing-chamber and the atmosphere, whereupon the air enters said chamber, which is immediately expanded by the spring 3. The valve-plug 15 is provided with a lever-arm, which is connected with a reciprocatory rod 16, held by spring 17 in the position corresponding with the normal position of the valve-plug. The reciprocatory spring-held rod 18 is supported in bearings in one arm of a lever 19, whose other arm is acted upon by a laterally-projecting foot 20 on the lower end of an upright vertically-movable bar 21 inside the bar *w*. Normally the rod 18 is dropped and the bar 21 raised; but when the controller *c* is brought to mid-position the cam 22 thereon acts upon the upper end of the bar 21 to depress the same and to raise the reciprocatory rod 18 into line with the rod 16. At such times movement can be transmitted from the spring-held rod 23 through the rod 18 to the rod 16 and valve 13. At other times, the rod 18 being out of line, any motion of the rod would be idle. This last-mentioned rod is connected with the reciprocatory piece 24, which coöperates across the gap with a reciprocatory piece 25. This latter is advanced and retracted in a direction transverse to the movement of the door *e* by a stored-power motor 26, mounted below the door on or in the wall of the elevator-shaft. The portion of the reciprocatory piece 24 which is directly opposite the piece 25 is cam-shaped, (see Fig. 6,) so that if the latter piece should be projected in advance of the arrival of the car at a landing the former will be operated by the movement of the cam-shaped portion over and in contact with the piece 25. The construction of the motor 26 is as shown in Figs. 2 and 3 and hereinbefore described with reference thereto. It is provided with a pipe connection 27, leading to the vacuum-cylinder 11. The three-way valve 28 (of the construction shown in Fig. 4 and already described) is placed in the pipe connection. It is governed by the arm 29, carried by the door *e* and provided with a roller engaging a fork 30 on the plug of the valve 28. Normally the valve (valve-plug) is in the position shown in Fig. 4, and the piece 25 is consequently retracted. When the door is moved to the left, its first movement shifts the valve-plug to break the vacuum in the collapsing chamber of the motor 26, whereupon the motor-spring projects the piece 25. At the same time the fork 30 is turned so that the roller may pass out to the left with the door. This first movement of the door is permitted while the door is still under the control of the latch *h*, because the device *m* is so set to be separated from the latch *h* by a suitable distance when the door is completely closed. In order that the first movement of the door should not leave an opening, the cover-strip 31 may be provided, as shown. The lock for the controller *c* is formed, as shown, by a dog 32, (at the upper end of the bar *w*,) which engages the notch *z* in the stop device or disk 2 on the controller whenever the bar *w* is raised with the controller in mid-position. At other times the bar *w* would be held down by the opposing surface of the stop device. The bar *w*, as shown, has two functions: It prevents the operation of the latch unless the controller is in mid-position. If operated when the controller is in mid-position, it locks the same. The two functions are shown as performed by the same part; but they are distinct. The dog 32 when occupying the notch locks (or, in other words, prevents the rotation of) the controller *c*. The stop device or disk 2 prevents the longitudinal movement of the bar *w* and consequent operation of the latch-op-

erating piece *t* except when the cut-away portion *z* is above said bar.

The operation of the mechanism as a whole is as follows: Normally the door is completely closed, being so held by the spring-pressed plate *s*, acting upon the cam-bar *p*, and the three-way valves 13 and 28 are in the vacuum-making position of Fig. 4. The latch *h* lies in the path of the device *m*, but separated therefrom by a certain interval. The reciprocatory pieces 25 and *t* are retracted, the upright bar *w* is lowered, and the upright bar 21 is raised. Thus the controller *c* is free to be moved, while the door *e* can only be moved so far as to bring the device *m* against the latch *h*, and this movement (which is not sufficient to open the door substantially, if at all) is resisted by the spring-pressed plate *s*, which would return the door to the completely-closed position so soon as released. Assuming that the car reaches a landing at which a stop is to be made, the controller *c* is brought to the mid-position. The effect of this is without other care on the part of the attendant for the cam 22 to depress the bar 21, and thus to raise the rod 18 into alinement with the rods 23 and 16 and for the notch *z* to be brought directly over the dog 32 on the upper end of the bar *w*. The attendant then opens the door *e* by moving it to the left. The first movement of the door shifts valve 28 so as to break the vacuum of motor 26, whereupon the motor-spring immediately projects the piece 25, which acts across the gap to press in the piece 24, and with it the rods 23, 18, and 16. The motion of the rod 16 shifts the valve 13 so as to break the vacuum of motor *x*, whereupon the motor-spring 3 lifts the upright bar *w*, engaging the dog 32 in the notch *z* to lock the controller *c* and rocking the shaft *v* in the direction to project the piece *t*, which acts across the gap upon the piece *j*, and so withdraws the latch *h* from the path of the device *m*. The attendant can therefore open the door to receive or to discharge passengers; but he cannot while the door is open move the controller *c* to start the car. When he closes the door, the device *m* passes the latch *h* and then the arm 29 engages the fork 30 and shifts the valve 28 so as to restore the vacuum in the collapsing chamber of motor 26, whereupon the piece 25 is retracted, the rods 23, 18, and 16 are advanced by their respective springs, the valve 13 is turned so as to restore the vacuum in the collapsing chamber of the motor *x*, the bar *w* is lowered, and the rock-shaft *v* is turned in the direction to withdraw the piece *t*, and so to allow the spring *l* to place the latch *h* in the path of the device *m*. The attendant can now revolve the controller *c* to start the car up or down, as the case may be, according to the direction in which the controller may be turned. The cam 22 being thus withdrawn from its position above the bar 21, this latter is raised by the weight of the rod 18, (or an appropriate spring,) and the rod 18 falls out of line with the rods 23 and 16. Should the door at any landing be moved by accident or design so far as to turn the valve 28, the piece 25 will be projected, whether the car is at the landing or not, and if notwithstanding the tendency of the pressure of the plate *s* to restore the door to the completely-closed position the piece 25 should stand projected at the time of the car's passing no harm results, for the cam shape of the piece 24 causes it to be pressed back by the piece 25, (or to press back the piece 25 if piece 24 should for any reason not yield.) If at this juncture the controller *c* should not be in mid-position, the rod 18 will be out of line, and the rod 16 and valve 13 and motor *x* will not be affected. Even if they should be moved yet if the notch *z* should not be directly above the dog 32 the bar *w* would be held down by the disk 2 and no motion would be imparted to the rock-shaft *v*. Should the attendant be intending to stop at that landing, however, the dog 32 would snap into the notch *z* so soon as the controller should be brought exactly in mid-position, whereupon the rock-shaft *v* would be turned so as to project the piece *t* and withdraw the latch *h* from the path of the device *m*. Should the controller be in mid-position, in order to stop the car at the time the car reaches a landing at which the door has been moved so as to project the piece 25, the piece 24, the rods 23 and 18 and 16 and the valve 13 would be shifted, and the motor *x* would be operated to lift the bar *w*, and so lock the controller, and to turn the rock-shaft *v*, and so project the piece *t* and withdraw the latch *h* from the path of the device *m*. Should the piece *t* at any time happen to be projected in advance of the arrival of the car at a landing, the cam shape of the latch-operating piece *j* enables the said piece to push in the piece *j*, and so to pass without damage.

In Fig. 7 the mechanism on the car includes the two reciprocatory pieces *t* and 24 on the car for coöperating across the gap with the respective reciprocatory pieces *j* and 25 on the elevator-shaft, as shown in Figs. 1 to 6. The controller *c*, as in these figures, is provided with a cam 22 for governing the upright vertically-movable bar 21 and a stop device or disk 2, notched at *z*. Instead, however, of governing the latch by the joint operation of the door *e* and the controller *c* it is governed by the latter alone. The bar 21 is connected at its lower end with a lever-arm 33 for turning the plug of the three-way valve 34, which is constructed as shown in Fig. 4 for the valve 13 and described above with reference thereto. A spring 35 (spiral tension-spring, as shown) holds up the bar 21. The motor 36, which is constructed as shown in Fig. 2 and described with reference thereto, has its vacuum broken and restored according to the

position of the valve 34. The reciprocatory piece *t* is projected and retracted directly by the motor 36. The reciprocatory piece 24 is connected by the link 37 with the vertical arm of a rock-shaft 38, a horizontal arm of which is connected with the lower end of the upright vertically-movable bar *w*. A spiral tension-spring 42 is shown for aiding the return of bar *w* and rock-shaft 38 and reciprocatory piece 24 when the influence of the piece 25 is withdrawn. Assuming the car to be at a landing at which a stop is to be made, the elevator attendant brings the controller *c* to the mid-position in order to stop the car, and in so doing depresses the bar 21 and shifts the valve 34 so as to break the vacuum in the motor 36, whose spring (same as spring 3 of Fig. 2) thereupon projects the piece *t* across the gap against the piece *j*, Figs. 1 to 6, to withdraw the latch *h* from the path of the device *m*. The attendant then opens the door and in so doing shifts the valve 28 into position to break the vacuum of motor 26, whose spring thereupon projects the piece 25 across the gap and forces inward the piece 24 and link 37. The link 37 turns the rock-shaft 38 and raises the upright bar *w* so that the dog 32 at its upper end enters the notch *z*, and thereby locks the controller. When the attendant wishes to start the elevator, he must first close the door. In so doing he shifts the valve 28 so as to reëstablish a vacuum in the motor 26, whereupon the piece 25 is retracted and the dog 32 is removed from notch *z*, thus allowing the controller to be turned. The act of turning the controller to start the car removes the cam 22 from its position above the upright bar 21, which at once rises, and in rising turns the valve 24 so as to reëstablish a vacuum in the motor 36, and thus retract the piece *t* and allow the latch *h* to place itself in the path of the device *m*.

With the arrangement of Fig. 7, inasmuch as the latch therein is governed only by the controller and not by the door, the latter need have no free movement while under the control of the latch, or, in other words, with the arrangement of Fig. 7 when the door is fully closed there may or may not be a space between the latch *h* and the device *m*.

In Fig. 8 the lock is operated, as in Fig. 7, by the link 37 and rock-shaft 38 and upright bar *w*, and the latch-operating piece *t* is shifted directly by the motor 36; but the latch is governed, like the lock, by the joint action of the door *e* (having a suitable movement while under the latch) and of the controller *c*, the valve 34 for the motor 36 having its lever-arm 33 connected with the upright bar *w*. Assuming the car to be at a landing at which a stop is to be made, the elevator attendant brings the controller *c* to the mid-position in order to stop the car. He then opens the door *e*. The first movement of the door to the left shifts the valve 28, which breaks the vacuum of the motor 26, Figs. 1 to 6, and allows the latter to project the piece 25. This latter acts across the gap and presses back the piece 24 and link 37, which turns the rock-shaft 38 and raises the upright bar *w* so that the dog 32 at its upper end enters the notch *z* to lock the controller. At the same time the valve 34 is turned (through the connection of its lever-arm 33 with the bar *w*) so as to break the vacuum of motor 36, which thereupon projects the piece *t* across the gap and withdraws the latch *h* from the path of the device *m*. If the controller should not be in mid-position when the attendant imparts to the door *e* its first movement to the left, the valve 28 would be shifted; but neither locking nor latching would take place, because the upward movement of the bar *w* would be resisted by the stop device or disk 2 on the controller *c*. No damage would result, because the spring of the motor 26 furnishes a yielding connection.

An additional yielding connection could be provided, if desired. Thus in Fig. 9 a spiral compression-spring 39 is interposed between the horizontal arm of the rock-shaft 38 and a collar 40 on the upright bar *w*. The rock-shaft arm can move loosely over the upright bar *w* and compresses the spring 39 if the motion of the upright bar *w* is resisted. A collar 41 is on the upright bar below the rock-shaft arm. When the attendant wishes to start the car, he closes the door *e*. In so doing he shifts the valve 28 so as to reëstablish a vacuum in the motor 26, whereupon the piece 25 is retracted, the dog 32 is removed from the notch *z*, (allowing the controller *c* to be turned,) and at the same time the piece *t* is retracted, (allowing the latch *h* to place itself in the path of the device *m*.)

In Figs. 10 to 13 there is no stored motor on the car. The power to operate the latch is taken from the controller, and the power to operate the lock is transmitted from across the gap. The power transmitted is shown as taken from the door, although it could evidently be taken from a stored-power motor, as described with reference to preceding figures. In Figs. 10 to 13 the reciprocatory piece on the elevator-shaft (which is marked 43 and takes the place of the piece 25 of Figs. 1 to 6) is carried by the spring-pressed plate *s* of Figs. 1 to 6, and the position of the controller on the car has been changed in view of this new location of said reciprocatory piece in order to simplify the operating mechanism as much as possible; but modifications can be made in this mechanism to suit the position of the controller if it should be preferred to have it in a particular place on the car. Mechanism on the car for operating the lock and latch (either or both) by the aid of a stored-power motor on the car, as before described with reference to Figs. 1 to 9, is not necessarily restricted to the use of a stored-power motor on the elevator-shaft also. Except that the reciprocatory piece 43

is carried by the spring-pressed plate *s* (which is forced outward by the cam-bar *p* during the first part of the movement of the door *e* to the left) and that the stored-power motor 26 of Fig. 1, with its accessories, is omitted from Figs. 10 to 13, the mechanism on the elevator-shaft is the same in these figures as in Figs. 1 to 6. Its parts are given the same letters of reference. The reciprocatory piece *t*, which acts from the car across the gap in coöperation with the piece *j* to withdraw the latch *h* from the path of the device *m*, is connected with the vertical arm of a rock-shaft 44, a horizontal arm of which underlies the upright bar 21. As in Fig. 7, this bar is raised by a spring and forced down by the cam 22 on the controller *c* when this comes to its mid-position. The spring is differently placed in Fig. 13, being indicated at 45. The reciprocatory piece 24 on the car, which is acted upon from across the gap by the piece 43, is (as in Fig. 7) connected by a link 37 with the vertical arm of a rocker, which is provided with a spring 42 and which has a horizontal arm connected with the lower end of the vertical bar *w*. The rocker in Figs. 10 to 13 is a bent lever 46 in place of a rock-shaft. The link in Figs. 10 to 13 is made with a pin 47 fitting in a tubular hole in the end of the link and pressed out by a spring 48. The function of this last is the same as that of the spring 39 of Fig. 9, which can be used instead of or in addition to the same. Assuming the car to have stopped at a landing, the attendant will have brought the controller *c* to mid-position and in so doing will have depressed the bar 21, rocked the shaft 44, and projected the piece *t*, which, acting across the gap, will in coöperation with the piece *j* have withdrawn the latch *h* from the path of the device *m*. The attendant then opens the door *e*, in the first movement of which the cam-bar *p* forces the spring-pressed plate *s* outward, so that the piece 43, carried by said plate, acts across the gap and (in coöperation with the piece 24) moves the link 37 and lever 46 and bar *w* so that the dog 32 enters the notch *z* and locks the controller *c*. To start the car, the door *e* is closed, and at the last of its closing motion the cam portion of the bar *p* passes under the plate *s* and allows the same, and the piece 43 carried thereby, to move toward the wall of the elevator-shaft, and so permit the upright bar *w* on the car to fall and remove the dog 32 from the notch *z*. The attendant now turns the controller *c* to start the car, and in so doing he removes the cam 22, which removal allows the upright bar 21 to rise and withdraw the piece *t*, which has been holding back the latch *h*, so that this latter interposes itself in the path of the device *m*. Should the door happen to be open before the car arrives at the corresponding landing, the piece 43 will stand projected; but the coöperating piece 24, being cam-shaped in its contact portion, Fig. 12, will ride over the piece 43. If the controller should be in mid-position, the piece 24 will transmit motion through link 37, lever 46, and bar *w* to the dog 32, so as to lock the controller. If it should not be in mid-position, the motion of the upright bar *w* would be resisted by the stop device or disk 2, and the car would move on until the piece 24 should pass the piece 43. The spring 48 or other yielding connection in the lock-operating mechanism would prevent damage. The spring 39 of Fig. 9 might be used instead of or in addition to the spring 48, or the piece 43 might be of spring metal stiff enough to raise the dog 32 if unresisted and yielding enough to give way if the motion of the dog should be prevented by the stop device or disk 2.

The arrangement of Figs. 14 to 17 resembles that of Figs. 10 to 13 in dispensing with stored-power motors. Like it also it governs the lock-operating mechanism by the joint action of the door and the controller: but it differs therefrom in that in Figs. 10 to 13 the latch-operating mechanism is governed by the controller alone, whereas in Figs. 14 to 17 it is governed by the joint action of the door and controller. In this last respect it resembles the arrangement of Figs. 1 to 6. Referring to Figs. 14 to 17, the same mechanism is shown on the elevator-shaft as in Figs. 10 to 13. The pieces *t* and 24, which coöperate across the gap with the pieces *j* and 43, respectively, are likewise the same, as are also the spring 45 for the piece *t* and the link 37, with its pin 47 and spring 48 for the piece 24. Moreover, this piece 24 is connected by a bent lever 46 with the lower end of an upright bar carrying the dog 32 for locking the controller by entering a notch *z*. The piece *t*, however, instead of being connected with a separate upright bar is connected with the upright bar with which the piece 24 is connected. The connection is made, as shown, through a lever 49 with the link 37, which is connected, as before said, with the upright bar which carries the dog 32. With a wheel-controller *c* the disposition of the stop device or disk 2, notch *z*, and bar *w* might be as shown in any of the hereinbefore-described arrangements. In Figs. 14 to 17 is shown a lever-controller 50, which might itself be used in place of the wheel *c* in any of the before-described arrangements, with modifications in the immediately-associated parts sufficiently indicated by Figs. 14 to 17—that is to say, the upright bar or bars may be mounted on the controller 50 and the coöperating devices on the controller *c* can be fixed in appropriate relation thereto. Thus, as shown, the stop device 51, which corresponds with the disk 2, is in the form of an arc supported by standards and is provided with the notch *z* for receiving the dog 32 when the lever is in mid-position. The upright bar 52, which corresponds with the bar *w*, is movable verti-

cally in bearings on the lever 50 and at its upper end carries the dog 32, while at its lower end it is connected with the bent lever 46 by resting upon the arc 53, which is mounted on the horizontal arm of the said bent lever 46. When the controller 50 is moved back and forth, the lower end of the upright bar 52 moves idly over the arc 53; but when this latter is raised and lowered the bar 52 partakes of these motions. Assuming that the car is at a landing and the controller in mid-position for stopping, the elevator attendant opens the door *e* and in so doing (before the device *m* reaches the latch *h*) causes the cam-bar *p* to force outward the spring-plate *s* and piece 43 carried thereby. The piece 43 acts across the gap to press in the piece 24 and link 37, and thereby to rock the levers 46 and and 49 so as on the one hand to raise the bar 52 and engage the dog 32 in the notch *z* and on the other to project the piece *t* and withdraw the latch *h* from the path of the device *m*. Before the attendant can start the car again he must close the door in order to allow the plate *s* and piece 24 to retire, and so permit the dog 32 to be removed from the notch *z*, while at the same time the piece *t* is retracted and permits the latch *h* to place itself again in the path of the device *m*. If a door should accidentally be open, the piece 43 will be forced outward, and when the piece 24 comes in front of the piece 43 the controller 50 will be locked if in mid-position or the spring 48 (or other yielding connection) will give way if the controller should be in other than its mid-position.

Referring to Fig. 18, the latch 54 moves in the plane of the door's movement instead of transversely thereto, as does the latch *h*, and the reciprocatory pieces 55 and 56, which correspond with the pieces *j* and *t*, respectively, of former figures, move parallel and not transversely to the door's movement, as do the pieces *j* and *t*. They move, however, transversely to the line of gap and not parallel thereto, as does the door *e*, because the line of gap where it passes the pieces 55 and 56 is at right angles to the said line where it passes between the door *e* and the car. In Fig. 18 means are indicated for using compressed air as stored power for actuating the motors *x* and 26. The fluid-pressure of the compressed air may be used instead of or in addition to spring-power, as before described. With these modifications and additions the arrangement of Fig. 18 is substantially that of Figs. 1 to 6, only certain parts shown in Fig. 1 are not shown in Fig. 18, but can obviously be used. Assuming the car to be at a landing, with the door *e* fully closed and the controller *c* in mid-position, the elevator attendant moves the door to the left. During the first part of its movement the arm 29 on the door shifts the valve 28 so as to break the vacuum of motor 26 and to put the collapsing chamber thereof in communication through the pipe connection 57 with the cylinder 58, which is kept full of compressed air by the pump 59. The collapsing chamber is inflated by the air, and the piece 25 is projected so that it acts across the gap to press back the rods 23, 18, and 16, and thereby to shift the valve 13 so as to break the vacuum of motor *x* and connect its collapsing chamber by the pipe connection 60 with the compressed-air cylinder 58. The motor *x* is operated to raise the upright bar *w* and lock the controller *c* by inserting the dog 32 into the notch *z*, while at the same time it rocks the lever 61, moves the link 620 to the right, rocks the shaft 62, and projects the piece 56, which presses back the piece 55 so as through the link 63 to rock the latch 54 and move it out of the path of the door. The operations of unlocking and latching by the closure of the door will be sufficiently evident from what has been before said. If the car approach a landing when the door is not fully closed and when the piece 25 is consequently projected, the piece 24 will ride over the piece 25. If the controller is in mid-position, the piece 24 will be pressed back, so as to lock the controller *c* and withdraw the latch 54, (if this is not already withdrawn.) If the piece 56 should be projected when the car is approaching a landing, the cam shape of the piece 55 allows the roller at the end of piece 56 to ride over and press back the piece 55.

In Figs. 19 and 20 the latch 64 engages an arm 65 in the door *e* and is carried by a piece 66, which rocks on a vertical axis. The axis of the piece *j* is horizontal. The latch 64, like the latch *h*, moves transversely to the movement of the door. At 67 is the spring which normally retains the latch in the path of the arm 65. The piece *t* of former figures acts against the corresponding portion of the piece 66, (which may be cam-shaped,) and when piece *t* is projected it overcomes the pressure of the spring 67 and pushes the said portion toward the wall of the elevator-shaft.

While a number of forms or modifications have been shown, the enumeration is not intended to be exhaustive; but further modifications can be made so long as the substance of any one or more of the hereinafter-written claims is taken. In these claims the expression of an element (in the singular) in any claim is not intended to exclude from said claim the use of two or more elements, and, conversely, the expression of elements (in the plural) in any claim is not intended to exclude therefrom the use of a single element, unless in each case there should also be present other words of plain restriction to a single element or to two or more elements, respectively. The claims are, of course, to be taken severally.

The term "collapsing chamber" is intended

to apply more particularly to a chamber one of the walls of which is formed of a flexible sheet; but the movable wall of such chamber could be formed otherwise. Thus a cylinder with piston working therein is a known form of collapsing chamber, the space below the piston collapsing or contracting when the piston moves inward.

In a concurrent application filed February 6, 1905, claims are made to features herein set forth and not special to Figs. 1 to 9 and 18 nor common to them and to other figures.

I claim as my invention or discovery—

1. A system of safety devices, in which a lock, and a latch, are combined with two sets of coöperating pieces, whereof each set includes a reciprocatory cam-shaped piece on one side of the gap and a coöperating piece on the other side of the same and is governed in common with the other set of coöperating pieces by movable appliances manipulated in running the elevator, as in starting and stopping the car, or in permitting and preventing the entrance and exit of passengers, substantially as described.

2. A system of safety devices, in which a lock and a latch are combined with lock-operating and latch-operating mechanism, which includes two horizontally-reciprocatory pieces, each movable transversely to the door's movement in coöperation with a piece on the other side of the gap and each operatively connected below the car-floor with the lower end of an upright vertically-movable bar, substantially as described.

3. A system of safety devices, in which a lock and a latch are combined with lock-operating and latch-operating mechanism that includes two horizontally-reciprocatory pieces, each movable transversely to the door's movement in coöperation with a reciprocatory piece on the other side of the gap and each operatively connected below the car-floor with the end of a longitudinally-movable bar, said mechanism also including a rocker mounted under the car-floor with the axis of rocking parallel with the door's movement and connected with the end of a longitudinally-movable bar, substantially as described.

4. The combination with a car, a door, a lock, and a controller, of an upright vertically-movable bar on the car, a reciprocatory piece mounted under the car-floor to move transversely to the door's movement and connected with the lower end of said bar, and a door-governed coöperating piece on the elevator-shaft, this latter piece serving to actuate the reciprocating piece first mentioned, substantially as described.

5. The combination with a car, a door, a lock, a latch, and a controller, of an upright vertically-movable bar on the car, a reciprocatory piece mounted under the car-floor to move transversely to the door's movement and connected with the lower end of said bar, a door-governed coöperating piece on the elevator-shaft, and a horizontally-reciprocatory piece under the car-floor, which last-mentioned piece is governed by said controller and coöperates with a latch-operating piece on the elevator-shaft, substantially as described.

6. The combination with a door, a controller, a controller-governed latch, and a door-governed lock, of a cam-bar on the door, and a spring-pressed plate mounted on the elevator-shaft and bearing on said cam-bar, the pressure of said plate against the incline of said cam-bar tending to close the door, substantially as described.

7. The combination with a reciprocatory latch-operating piece located on one side of the gap and movable transversely to the door's movement, of a rock-shaft mounted on the other side of the gap parallel with the door's movement and connected with a horizontally-reciprocatory piece operating across the gap to release the latch, substantially as described.

8. The combination with a reciprocatory latch-operating piece located on one side of the gap and movable transversely to the door's movement, of a rock-shaft mounted on the other side of the gap parallel with the door's movement and connected with a horizontally-reciprocatory piece operating across the gap to release the latch, and a lock-operating mechanism, which includes a door-governed reciprocatory piece movable parallel with the motions of said former pieces, substantially as described.

9. The combination with a reciprocatory latch-operating piece located on one side of the gap and movable transversely to the door's movement, of a controller-governed rock-shaft mounted on the other side of the gap parallel with the door's movement and connected with a horizontally-reciprocatory piece operating across the gap to release the latch, substantially as described.

10. The combination with a reciprocatory latch-operating piece located on one side of the gap and movable transversely of the door's movement, of a controller-governed rock-shaft mounted on the other side of the gap parallel with the door's movement and connected with a horizontally-reciprocatory piece operating across the gap to release the latch, and a lock-operating mechanism, which includes a door-governed reciprocatory piece movable parallel with the motions of said former pieces, substantially as described.

11. A system of safety devices in which a lock and a controller arranged to resist locking except when in mid-position are combined with lock-operating mechanism which includes both a reciprocatory cam-shaped piece operating across the gap and a yielding connection through which the locking motion is transmitted, substantially as described.

12. A system of safety devices in which a lock and a controller arranged to resist lock-

ing except when in mid-position are combined with lock-operating mechanism which includes both a reciprocatory cam-shaped piece operating across the gap and a yielding connection through which the locking motion is transmitted, and also with a controller-governed latch, substantially as described.

13. A system of safety devices in which a lock and a controller arranged to resist locking except when in mid-position are combined with a door-governed rock-shaft mounted on the other side of the gap parallel with the door's movement and connected with a horizontally-reciprocatory piece operating across the gap to release the latch, and also with a controller-governed latch, substantially as described.

14. A system of safety devices in which a latch is combined with controller-governed latch-operating mechanism which includes a stored-power motor, and also reciprocatory pieces located on opposite sides of the gap, substantially as described.

15. A system of safety devices in which a lock and a latch are combined with door-governed lock-operating and controller-governed latch-operating mechanism which includes reciprocatory pieces on opposite sides of the gap and stored-power motors operatively connected with said lock and said latch for actuating both of them by stored power, substantially as described.

16. A system of safety devices in which a latch is combined with a stored-power motor having a collapsing chamber, a communicating pipe connection, and a controller-governed valve in said pipe connection, substantially as described.

17. A system of safety devices in which a latch is combined with latch-operating mechanism which includes reciprocatory pieces on opposite sides of the gap, a stored-power motor having a collapsing chamber, a communicating pipe connection, and a controller-governed valve in said pipe connection, substantially as described.

18. A system of safety devices in which a lock and a latch are combined with controller-governed latch-operating and door-governed lock-operating mechanism which includes reciprocatory pieces on opposite sides of the gap, together with a stored-power motor, substantially as described.

19. A system of safety devices in which a lock and a latch are combined with operating mechanism which is governed as to both lock and latch by the joint action of the controller and the door and which includes a stored-power motor, substantially as described.

20. The combination with a car, a door, a latch, a stored-power motor on the same side of the gap as said door, and latch-operating mechanism operatively connected with said motor and including reciprocatory pieces on opposite sides of said gap, substantially as described.

21. The combination with a car, a door, a latch, a door-governed piece acting across the gap, a stored-power motor on the other side of said gap, and latch-operating mechanism operatively connected with said door-governed piece and said motor, substantially as described.

22. The combination with a car, a door, a latch, a stored-power motor on the door side of the gap, a second stored-power motor on the opposite side of the gap, and latch-operating mechanism operatively connected with both said motors, substantially as described.

23. The combination with safety devices, including means for preventing or permitting according to position the movement of an appliance which is manipulated in running the elevator, of operating mechanism which includes a stored-power motor in the form of a normally retracted spring, substantially as described.

24. The combination with a car, a door, and a latch, of a door-governed actuating-piece operating transversely to the line of gap, a coöperating piece actuated thereby on the other side of the gap, and other latch-operating mechanism operatively connected with the last-mentioned piece, substantially as described.

25. The combination with a car, a door, and a latch, of a controller provided with a cam, reciprocatory pieces coöperating across the gap transversely to the door's movement, and other latch-operating mechanism operatively connected with said cam and said pieces, substantially as described.

26. The combination with a car, a door, a lock, and a latch, of controller-governed reciprocatory pieces coöperating across the gap transversely to the door's movement, and door-governed reciprocatory pieces coöperating across the gap transversely to the line thereof, substantially as described.

27. The combination with a car, a door, a lock, and a latch, of two sets of reciprocatory pieces, those of each set coöperating across the gap transversely to the line thereof, and both sets being governed by the joint action of the door and the controller, substantially as described.

28. The combination with a car, a door, a lock, and a latch, of two sets of reciprocatory pieces, those of each set coöperating across the gap transversly to the line thereof, and being governed one set by the controller and the other by the joint action of the door and the controller, substantially as described.

29. The combination with a car, a door, a lock, and a latch, of operating mechanism which includes a yielding connection and also two sets of reciprocatory pieces, those of each set coöperating across the gap transversely to the line thereof, and both sets being governed by the joint action of the door and the controller, substantially as described.

30. The combination with a car, a door, a

lock, and a latch, of operating mechanism which includes two sets of reciprocatory pieces, those of each set coöperating across the gap transversely to the line thereof, being governed one set by the controller and the other by the joint action of the door and the controller, and which also includes a yielding connection in the mechanism actuated by the last-mentioned set, substantially as described.

31. The combination with a car, a controller, a door, a lock, and a latch, of a stop and dog engaging device connected with said controller, and lock-operating and latch-operating mechanism which includes rockers under the car-floor, an upright bar connected at the bottom with said rockers and at the top with a dog for locking the controller, and two sets of reciprocatory pieces, those of each set cooperating across the gap transversely to the line thereof, substantially as described.

32. The combination with a car, a controller, a door, a lock, and a latch, of a cam connected with said controller, a dog-engaging device also connected with said controller, and lock-operating and latch-operating mechanism, which includes rockers under the car-floor, two upright bars connected at their respective lower ends with said rockers, and two sets of reciprocatory pieces, the upper end of one of said bars carrying a dog, the upper end of the other bar engaging said cam, and the reciprocatory pieces of each of said sets coöperating across the gap transversely to the line thereof, substantially as described.

33. The combination with a car, a controller, a door, a lock, and a latch, of a stop and dog engaging device connected with said controller, and lock-operating and latch-operating mechanism which includes a stored-power motor, rockers under the car-floor, an upright bar connected at the bottom with said rockers and at the top with a dog for locking the controller, and two sets of reciprocatory pieces, those of each set coöperating across the gap transversely to the line thereof, substantially as described.

34. The combination with a car, a controller, a door, a lock, and a latch, of a cam connected with said controller, a dog-engaging device also connected with said controller, and lock-operating and latch-operating mechanism which includes a stored-power motor, rockers under the car-floor, two upright bars connected at their respective lower ends with said rockers, and two sets of reciprocatory pieces, the upper end of one of said bars carrying a dog, the upper end of the other bar engaging said cam, and the reciprocatory pieces of each of said sets coöperating across the gap transversely to the line thereof, substantially as described.

35. A system of safety devices in which a lock is combined with a lock-operating mechanism, which is governed by the joint action of the door and controller, and which includes a stored-power motor and also reciprocating pieces located on opposite sides of the gap, substantially as described.

36. A system of safety devices which includes a stored-power motor having a collapsing chamber with one wall thereof formed of a flexible sheet, and a cap over said sheet, and also having a bar or pin projecting through a hole in said cap, and a flange or plate of greater diameter than the hole in said cap, substantially as described.

37. The combination with a car, a door, a latch, and a door-governed piece acting transversely to the line of gap, of two interconnected reciprocatory pieces movable transversly to the line of gap, one being actuated across the gap by said door-governed piece and the other acting across the gap to release said latch, substantially as described.

38. The combination with a car, a door, a latch, a controller, a lock, and a door-governed piece acting transversely to the line of gap, of two reciprocatory pieces connected with said lock and also interconnected to move in opposite directions transversly to the line of gap, one being actuated across the gap by said door-governed piece and the other acting across the gap to release said latch, substantially as described.

39. A system of safety devices for elevators, which is characterized by the combination with interconnecting mechanism, of the hinged reciprocatory piece 24, and the sliding reciprocatory piece *t*, both movable transversly to the line of gap, and the piece *t* moving out when the piece 24 is moved in, substantially as described.

40. A system of safety devices for elevators, which is characterized by the combination with interconnecting mechanism, of two parallel longitudinally-reciprocating rods or pins sliding in bearings, one moving outward to transmit pressure across the gap when the other is moved inward by pressure transmitted across the gap, substantially as described.

41. The combination with two reciprocatory pieces located on the same side of the gap and movable transversely to the line of gap, of a controller-governed mechanism mounted on the other side of the gap and including two horizontally-reciprocatory pieces coöperating across the gap with the first-mentioned pieces, substantially as described.

42. The combination with a car, a door, a lock, a latch, and a controller, of a reciprocatory latch-releasing piece located on one side of the gap and movable transversely to the line of gap, a door-governed reciprocatory piece located on the same side of the gap and movable transversely to the line of gap, and a controller-governed mechanism mounted on the other side of the gap and connected with said lock and including two horizontally-reciprocatory pieces coöperating across the gap

with the first-mentioned pieces, substantially as described.

43. The combination with a car, a door, a latch, a controller, and a door-governed piece acting transversely to the line of gap, of a controller-governed mechanism mounted on the car and connected with said lock and including two reciprocatory pieces movable transversely to the line of gap, one being actuated across the gap by said door-governed piece and the other acting across the gap to release said latch, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

THOMAS W. JENKINS.

Witnesses:
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SETH BUCKLEY.

No. 787,208. PATENTED APR. 11, 1905.

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LOCKING MECHANISM FOR ELEVATORS.

APPLICATION FILED MAY 20, 1904.

3 SHEETS—SHEET 1.

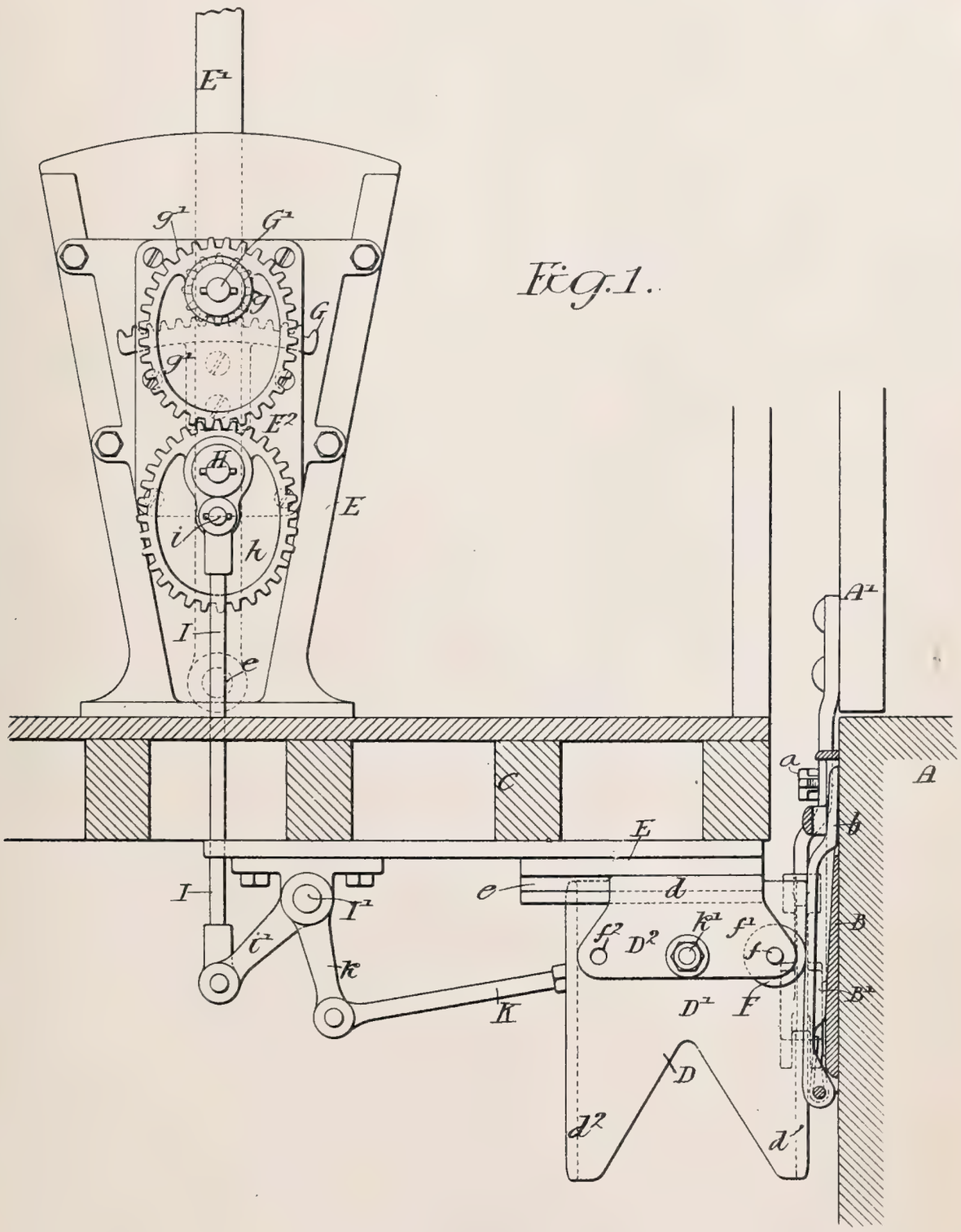

Fig. 1.

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No. 787,208. PATENTED APR. 11, 1905.

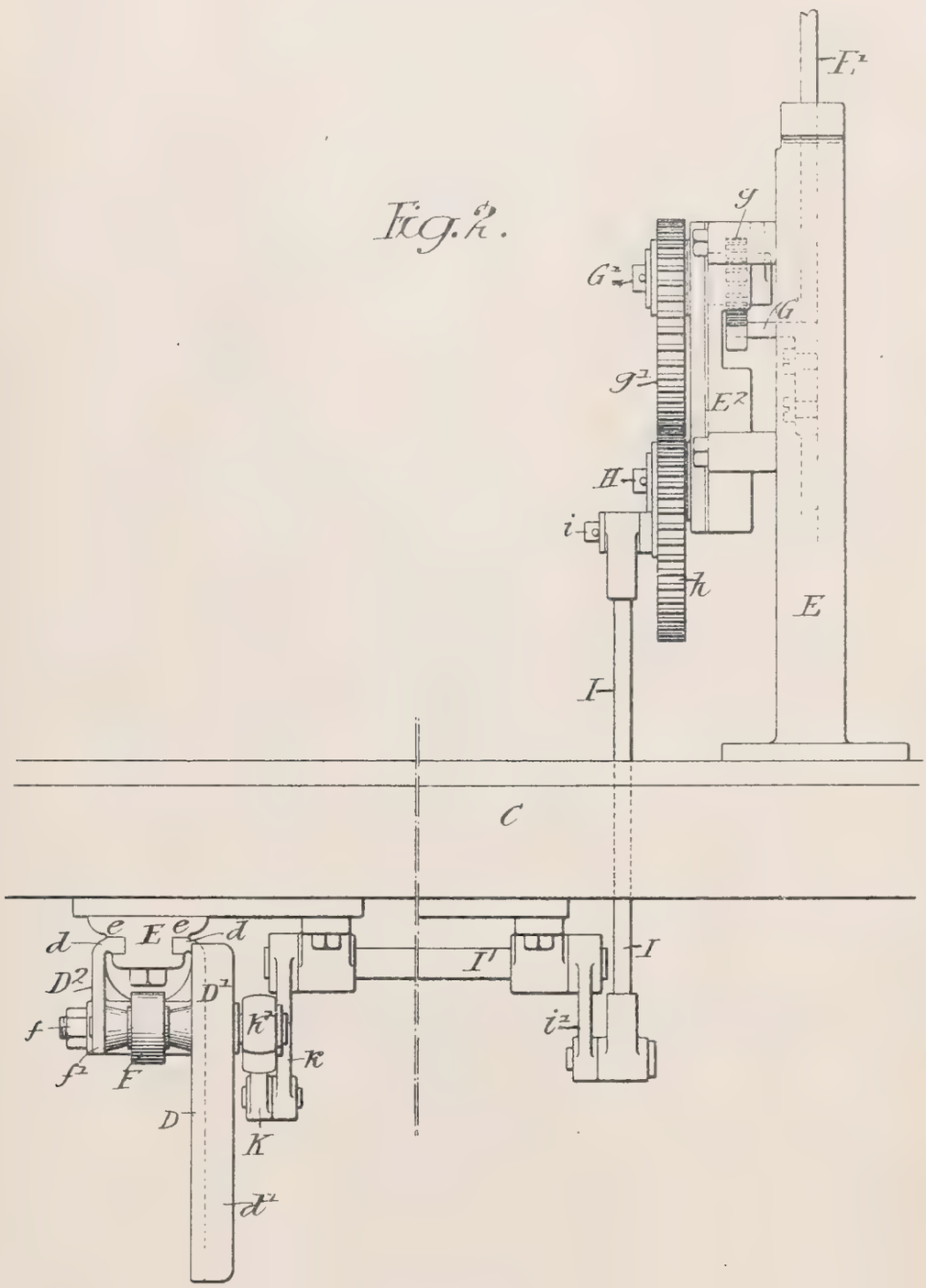
J. S. MUCKLÉ.

LOCKING MECHANISM FOR ELEVATORS.

APPLICATION FILED MAY 20, 1904.

3 SHEETS—SHEET 2.

Fig. 2.



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Peter W. Frost

Inventor:
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by his Attorneys;
Howson & Howson

No. 787,208. PATENTED APR. 11, 1905.

J. S. MUCKLÉ.

LOCKING MECHANISM FOR ELEVATORS.

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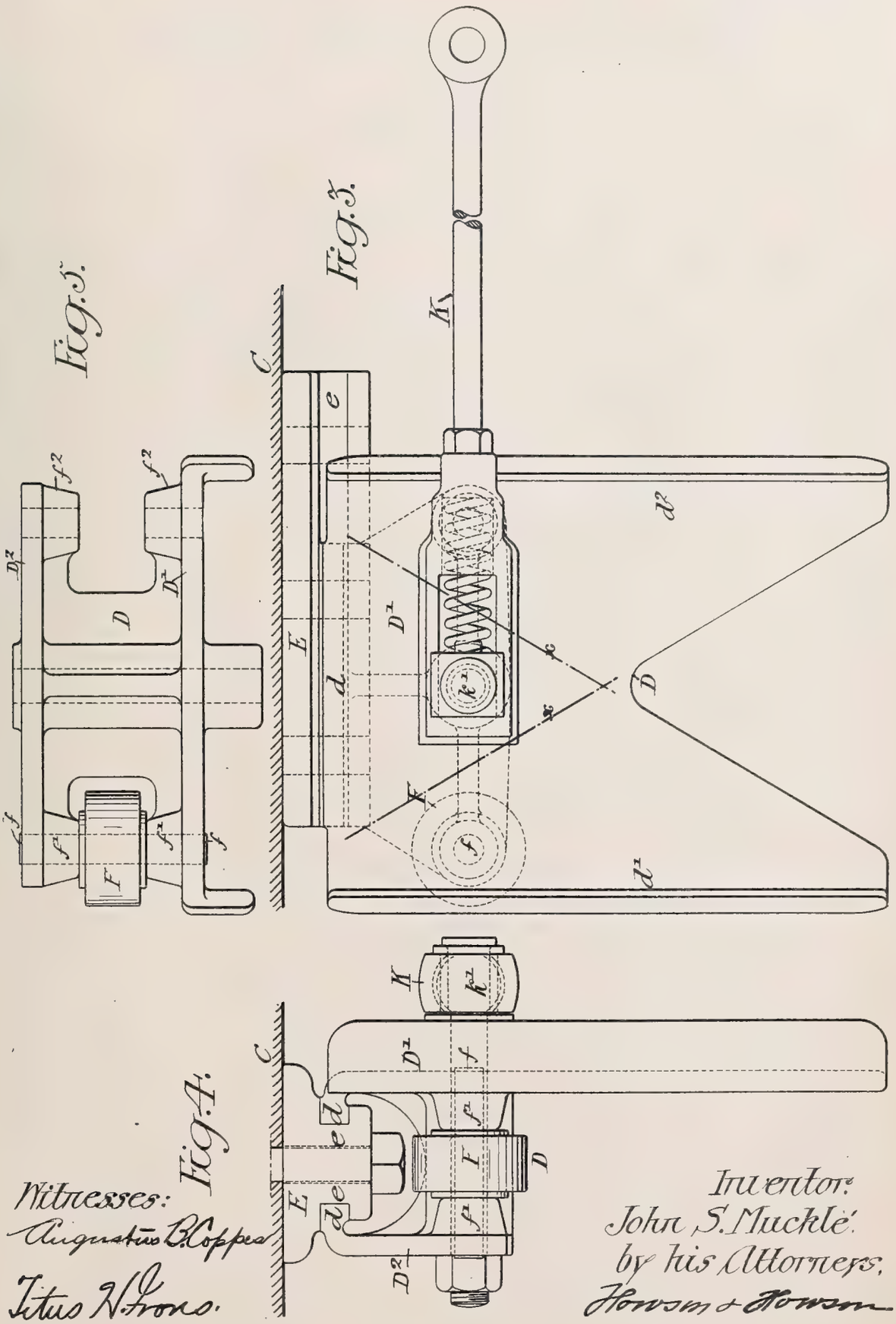
3 SHEETS—SHEET 3.



Witnesses:
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by his Attorneys,
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No. 787,208. Patented April 11, 1905.

UNITED STATES PATENT OFFICE.

JOHN S. MUCKLÉ, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO STANDARD ELEVATOR INTERLOCK COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

LOCKING MECHANISM FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 787,208, dated April 11, 1905.

Application filed May 20, 1904. Serial No. 208,962.

To all whom it may concern:

Be it known that I, JOHN S. MUCKLÉ, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Locking Mechanism for Elevators, of which the following is a specification.

The main object of my invention is to so design the plunger of a locking device for elevators that it can be cheaply and accurately made and can be used in connection with a door opening either to the right or left.

A further object of the invention is to provide a lever-controlled elevator mechanism, preferably of the type in which ropes are used, with means for locking said mechanism when the elevator is at a landing and the door is opened.

These objects I attain in the following manner, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional view of an elevator-car and part of the well, illustrating my invention. Fig. 2 is an end view of the elevator-car shown in Fig. 1. Fig. 3 is an enlarged side view of the plunger and its slide. Fig. 4 is an end view of Fig. 3, and Fig. 5 is an inverted plan view of Fig. 3.

A is the landing, having a door A′ locked in its closed position by a spring-actuated arm *b*, which is mounted on a plate B, secured to the wall of the elevator-well. This arm engages a catch *a* on the door and can only be released by means of a plunger on the car.

C is a car, and D is a plunger, which is mounted on a slideway E, secured to the under side of the car. The plunger is operated by mechanism connected to the operating-lever of the car, so that it can be forced out to contact with the spring-arm, which locks the landing-door. Heretofore this plunger had to be specially designed for either a right or left hand door; but my improved plunger is so designed that it can be used either for a right or a left hand door.

The slideway E has a groove *e* at each side, in which slide the flanges *d d* on the side plates D′ D² of the plunger D. These side plates are spaced a sufficient distance apart for the reception of the roller F for actuating the arm *b* on the plate B. The roller is mounted on a stud *f*, carried by bearings *f*′ on one end of the plunger. There are also bearings *f*² on the opposite end of the plunger, as clearly shown in Fig. 5, so that the roller and its stud can be mounted at either end of the plunger. The side plate D′ is extended, as clearly shown in Figs. 3 and 4, forming a V-shaped recess, and at one end of the plate is a flange *d*′ and at the opposite end of the plate is a flange *d*².

On the plate B, attached to the wall of the elevator-well, is a weighted lever B′, which is released when the door is moved, and as soon as it is released it engages in the present instance the flange *d*′ of the plunger, locking the plunger to the elevator-well. The plunger, as will be described hereinafter, is connected directly to the lever mechanism for starting and stopping the car, so that it will be seen that as soon as the plunger is locked the operator cannot move the car until the door is again closed and the locking-lever B′ thrown to such a position that it releases the plunger.

E is a lever-stand within the car. This stand is mounted on the floor of the car, and pivoted to the stand at *e* is an operating-lever E′. By moving this operating-lever from the center to the right, for instance, the operating mechanism can be shifted so as to raise the car, whereas by moving it to the left the mechanism will be shifted to lower the car, and if the lever remains in the central position then the lever mechanism is at rest. When the car is at a landing, the lever is always in the center position. The lever and the operating mechanism form no part of my present invention; but it is the application of my improved locking mechanism to this form of controlling device that I wish to claim.

Secured to the lever E′, by bolts in the present instance, is a toothed segment G, which meshes with a pinion *g* on a shaft G′, having its bearings in a casting E², secured

to the frame E. On the shaft G′ is an elliptical gear-wheel g', which meshes with another elliptical gear, h, on a shaft H. Projecting from the gear h is a pin i, to which is connected a rod I, in the present instance attached to a lever i' on a rock-shaft I′, mounted in bearings on the under side of the car. On the shaft I′ is a second lever k, which is connected by a rod K to a pin k' on the plunger D, as clearly shown in Fig. 3, so that when the lever is in its central position the plunger is projected, and if the car is in line with the platform it will actuate the spring-arm b on the plate in the elevator-well and release the door A′, and as soon as the door is opened the locking-lever B′ will engage the flange of the plunger and hold the plunger and the operating mechanism on the car until the door is closed. As soon as the lever is moved to start the car in either direction the plunger is withdrawn and the door is locked and cannot be opened until the car is at the landing.

In equipping the elevators in buildings with the improved locking attachment the plunger has to be arranged for either doors opening at the right or left hand side of the elevator-well, and by providing the plunger with the two flanges d' d^2, as shown in Figs. 3 and 5, the plunger can be adjusted in the slideway so that the locking-lever will properly engage the flange. The plate B is also made double, and the locking-lever B′ can be located on either side of the plate, as fully set forth in an application for patent filed by me on the 14th day of July, 1903, Serial No. 165,481.

The plunger D, which has a flange at each end, as described, is so made that if it is desired to remove one of the flanges and one of the bearings f' or f^2 the plunger may be broken on either of the diagonal lines x, the plunger being so designed that the removal of a portion of the plunger will not reduce its bearing on the slide nor change the position of the connecting-pin k'. The casting can be grooved, if desired, on the lines x to indicate the line of fracture. The object of making the plunger in such a manner is to enable it to be used in places where the full plunger would interfere with some of the mechanism under the elevator-car.

I claim as my invention—

1. A plunger for the locking mechanism of an elevator, consisting of two side plates each having a flange and spaced apart to receive a roller, substantially as described.

2. A plunger for the locking mechanism of an elevator, consisting of two side plates each having a flange and spaced apart to receive a roller, one side plate having a vertical flange at one edge, substantially as described.

3. A plunger for the locking mechanism of an elevator, having two side plates spaced apart, one side plate being more extended than the other and having a flange at each edge, so that the plunger can be reversed, and each side plate having an inwardly-projecting flange at the upper edge, substantially as described.

4. A plunger for the locking mechanism of an elevator, having two side plates, one side plate being more extended than the other and having a vertical flange at each edge, and each plate having an inwardly-projecting flange at the upper edge and said plates being spaced apart to receive a roller, substantially as described.

5. A plunger for the locking mechanism of an elevator, having a central pin for a connecting-rod and having a vertical flange at each end, a bearing back of each flange for a roller, and flanges adapted to a slideway, the plunger having a V-shaped recess in its under side, the plunger being so proportioned that one of the vertical flanges and a bearing can be removed without interfering with the balance of the plunger, substantially as described.

6. A plunger for the locking mechanism of an elevator, consisting of two plates connected together and having flanges adapted to a slideway, one of said plates having vertical flanges at each end, with a bearing at each end of the plate for the spindle of a roller so that the roller can be placed at either end of the plunger, substantially as described.

7. The combination of a guideway secured to the bottom of an elevator having grooves at each side, a plunger having two side plates each provided with an inturned flange adapted to the grooves in the slideway, and a vertical flange at each end of one of the plates, substantially as described.

8. The combination of an elevator-car, a stand therein, an operating-lever pivoted to the stand, a segment attached to the operating-lever, a frame secured to the stand and having bearings, two shafts mounted in the bearings, a pinion on one shaft meshing with the segment, an elliptical gear on the said shaft, an elliptical gear on the other shaft meshing with the first-mentioned elliptical gear, a rock-shaft on the car, two arms on the rock-shaft, a connecting-rod attaching the crank-pin of one elliptical gear to one arm of the rock-shaft, a plunger mounted on a slideway on the car, and a connecting-rod attaching the other arm of the rock-shaft to the plunger, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN S. MUCKLÉ.

Witnesses:
WILL. A. BARR,
JOS. H. KLEIN.

No. 798,124. PATENTED AUG. 29, 1905.

L. J. ADAMS.

AUTOMATIC SAFETY CUT-OFF FOR ELEVATORS.

APPLICATION FILED MAY 20, 1903.

Fig. 1.

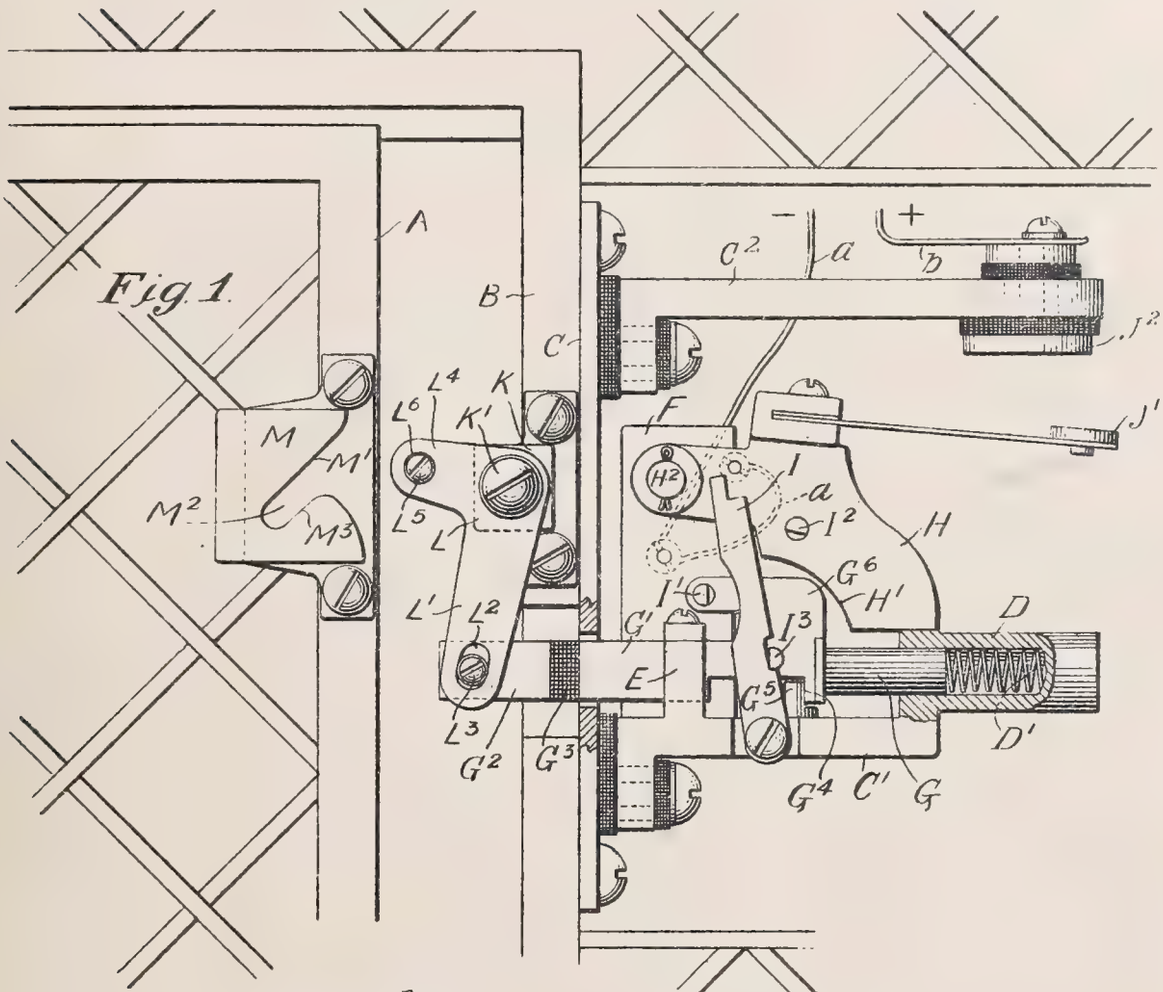
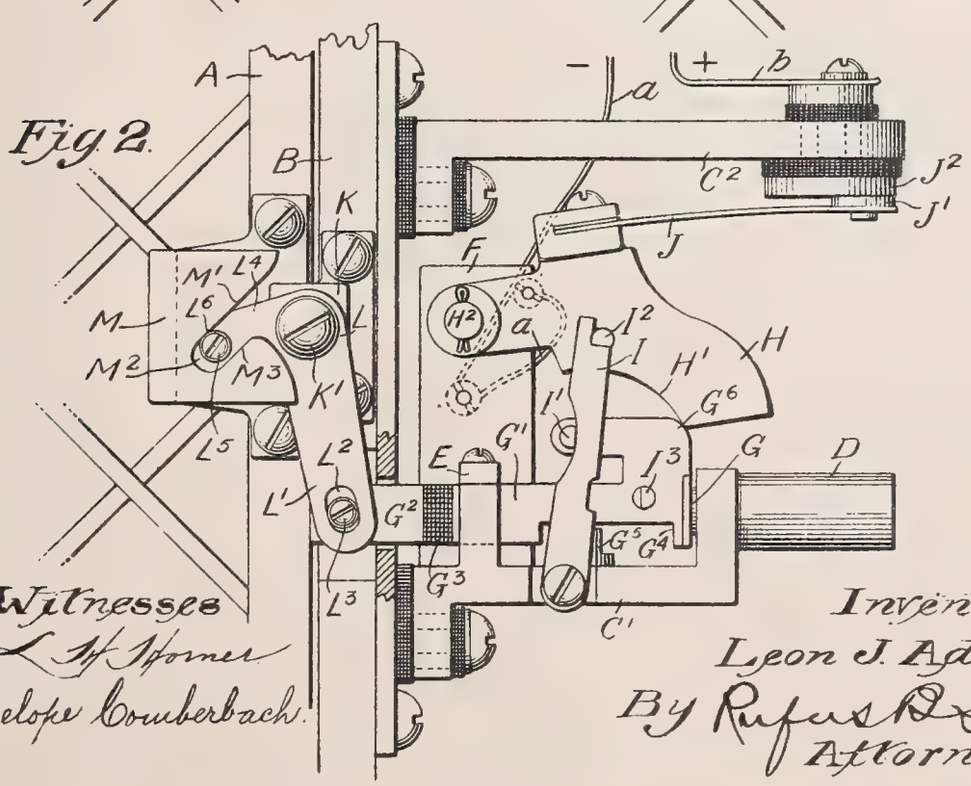


Fig. 2.



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Penelope Comberbach.

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UNITED STATES PATENT OFFICE.

LEON J. ADAMS, OF PROVIDENCE, RHODE ISLAND.

AUTOMATIC SAFETY CUT-OFF FOR ELEVATORS.

No. 798,124. Specification of Letters Patent. Patented Aug. 29, 1905.

Application filed May 20, 1903. Serial No. 157,893.

To all whom it may concern:

Be it known that I, LEON J. ADAMS, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented a new and useful Improvement in Automatic Safety Cut-Offs for Elevators, of which the following is a specification, accompanied by drawings forming a part of the same, in which—

Figure 1 is a side elevation, partly shown in section, of a safety cut-off for elevators embodying my invention and showing the position of the operating parts when the electrical circuit is broken. Fig. 2 is a side elevation of the same device, showing the position of the parts when the circuit is closed.

Similar letters of reference refer to similar parts in both views.

The object of my invention is to provide a safety device adapted to be used with elevators in which the elevator-operating mechanism comprises an electric circuit, the completion of which is necessary for the operation of the elevator-car, and the device embodying my invention is adapted to break the electric circuit whenever the elevator-door is opened, and thereby prevent the movement of the car, rendering the elevator inoperative except when the elevator-door is closed.

Referring to the accompanying drawings, A denotes the elevator-door, represented in Fig. 1 as partially open and capable of a sliding movement to bring it into contact with the door-jamb B when closed. Attached to the jamb B is a supporting-plate C, upon which the operating parts of my improved safety cut-off are mounted. Attached to the plate C by insulated connections are the brackets C′ and C^2. The bracket C′ supports a cylindrical casing D and the posts E and F. Sliding in suitable bearings in the casing D and post E is a sliding bolt G, provided with a rectangular section G′, which slides in the post E, and with a brass tip G^2, attached by an insulated joint G^3 with the rectangular section G′. The casing D contains a spiral spring D′, which presses against the end of the sliding bolt G to normally hold its shoulder G^4 against a stop-pin G^5, held in the bracket C′. In this position of the bolt G its tip G^2 projects through a suitable opening in the plate C and door-jamb B in the path of the door A, so that the operation of closing the door will impart a longitudinal movement to the sliding bolt G against the compression of the spiral spring D′, forcing the bolt from the position shown in Fig. 1 to the position shown in Fig. 2. The sliding bolt G is provided with a projecting shoulder G^6, which, as the bolt is pushed in by the closing of the elevator-door, is moved against the curved cam-surface H′ of a lever H, pivoted on a stud H^2, which is held in the post F. The inward movement of the sliding bolt G lifts the lever H from its normal position with its tip resting upon the casing D, as shown in Fig. 1, to the position shown in Fig. 2. In the elevated position of the lever H, as shown in Fig. 2, it is supported by a latch I, which is pivoted at its lower end to the bracket C′ and is swung on its pivotal connection by the stud I′, carried by the sliding bolt to bring the free end of the latch beneath a stud I^2, held in the lever H.

Attached to the lever H is a blade-spring J, carrying at its free end an electric contact-plate J′, which is brought by the upward rocking of the lever H against the contact-plate J^2, which is supported by and insulated from the bracket C^2, but has an electrical connection with the wire *b*, forming part of the electric circuit. The lever H is electrically connected with a wire *a*, also forming part of the electric circuit, so that by the contact of the plates J′ and J^2 the circuit is closed. When the door A is moved away from the door-jamb B in the operation of opening the door, the movement of the sliding bolt G is reversed by the tension of the spiral spring D′, which carries the shoulder G^6 away from the lever H; but the lever H is held in its elevated position by the latch I until the latter is swung from beneath the stud I^2 by means of the stud I^3, carried by the sliding bolt G. The removal of the latch I permits the lever H to fall by gravity and to instantly open the circuit by the removal of the plate J′ from the plate J^2, when the operative parts of the mechanism again assume their normal position, as shown in Fig. 1. The upward movement of the lever H is continued for a short period after the contact of the plate J′ against the plate J^2, thereby causing a slight bending of the blade-spring J, as shown in Fig. 2, by which a pressure is applied to the contact-plates equal to the elastic force of the blade-

spring J, and in addition the curvature of the spring causes a slight sliding movement between the contacting surfaces of the plates J′ and J^2 and a slight period of dwell is given to the contact-plate J′, due to the lost motion of the stud I^3 before it is brought into contact with the latch I on the reversal of the sliding bolt G. The contact of the stud I^3 with the latch I near its pivoted end causes a quick movement of the free end of the latch, and the downward movement of the lever H by gravity is then accelerated by the elasticity of the blade-spring J, which is in a state of tension, thereby producing an instantaneous break in the circuit. As the contact-plate J′ during the upward movement of the lever H approaches the contact-plate J^2 in a line at substantially right angles with their contacting surfaces the contact of the plate J′ with the plate J^2 is instantaneous and complete throughout its entire surface.

I am aware that safety cut-off devices for elevators comprising a sliding bolt which is actuated by the movement of the elevator-door is not new; but the several features of construction and operation of my improved device by which the circuit is maintained for a period independently of the movement of the door and in which the contact-plates make an instantaneous face-to-face contact with the yielding pressure applied thereto and with a slight sliding movement of the contacting surfaces I believe to be broadly new.

In the operation of the mechanism, as above described, the reversal of the sliding bolt G and the separation of the contact-surfaces are effected by means of the spiral spring D′. As a precaution against the breaking of the spring, I attach to the door-jamb B a bracket K, carrying a stud K′, upon which I pivot a bell-crank lever L, having one of its arms L′ provided with a slot L^2, which incloses a stud L^3 on the sliding bolt G. The other arm L^4 carries a stud L^5, on which a roll L^6 is arranged to be struck by the oblique edge M′ of a plate M, which is attached to the door A, so that the roll L^6 will pass into the oblique slot M^2 as the door A is closed, and as the door is opened the oblique edge M^3, acting against the roll L^6, will serve to rock the bell-crank L and reverse the motion of the sliding bolt G independently of the spring D′.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a safety cut-off for elevators, the combination with a sliding spring-actuated bolt projecting into the path of the elevator-door, of a rigid pivoted lever, a movable contact-plate carried by said lever, a fixed contact-plate in the path of said movable plate, means carried by said bolt for rocking said lever, thereby making a contact between said contact-plate and said movable plate, and means whereby said contact is broken by the action of gravity.

2. In an elevator safety cut-off, the combination with a sliding bolt projecting into the path of the elevator-door, of a spring for reversing the movement of said bolt, a shoulder on said bolt arranged to contact with a pivoted lever, a pivoted lever, an electrical contact-plate carried by said lever, a fixed contact-plate, a pivoted latch arranged to hold said lever with said plates in contact, and means carried by said sliding bolt for actuating said latch, substantially as described.

3. The combination with a pair of contact-plates forming electrical terminals, of means for bringing said terminals into contact comprising a sliding bolt a stud carried by said bolt a pivoted lever carrying one of said terminals, and arranged to be actuated by said sliding bolt, a latch by which said lever is held in position, and means carried by said bolt for actuating said latch, substantially as described.

4. In a safety cut-off for elevators, the combination of a sliding bolt arranged to be moved in one direction by the closing of the elevator-door, a spring by which the movement of the bolt is reversed, a pivoted lever arranged to be lifted by said bolt, a latch for supporting said lever in an elevated position, means carried by said bolt for actuating said latch, a fixed contact-plate, a blade-spring carried by said pivoted lever, a movable contact-plate carried by said blade-spring, and a shoulder on said bolt arranged to move said pivoted lever and impart a tension to said blade-spring as the contact-plates are brought together, substantially as described.

5. In a safety cut-off for elevators, the combination with a fixed electric terminal, of a pivoted member, a terminal carried by said pivoted member, means operated by the elevator-door for actuating said pivoted member to bring the terminals into contact, a latch for holding said terminals in contact, and means for releasing said latch, substantially as described.

6. In a safety cut-off for elevators, the combination of a fixed terminal, a pivoted lever, a movable terminal carried by said lever, a sliding bolt adapted to move said lever against gravity, a latch for supporting said lever in its elevated position, a stud carried by said bolt for moving said latch into engagement with said lever, and a stud carried by said bolt for disengaging said latch on the reverse movement of said lever, substantially as described.

7. In a cut-off for elevators comprising a pair of electric terminals and a sliding bolt, of a bell-crank lever pivoted upon a fixed stud, with one of its arms operatively connected with said sliding bolt and having its other arm extending into the doorway of an elevator, and an actuating-plate carried by the elevator-

door by which said bell-crank lever is reversed, substantially as described.

8. The combination with a pair of electric terminals of actuating mechanism for bringing said terminals into contact and separating the same, and comprising a sliding bolt, a bell-crank lever operatively connected with said bolt, and a plate carried by the elevator-door, by which said bell-crank is rocked as the door is moved, substantially as described.

Dated this 9th day of May, 1903.

LEON J. ADAMS.

Witnesses:
RUFUS B. FOWLER,
PENELOPE COMBERBACH.

No. 823,478. PATENTED JUNE 12, 1906.

J. A. MILLER.

SAFETY SYSTEM FOR MOTOR PROPELLED CARS.

APPLICATION FILED NOV. 6, 1905.

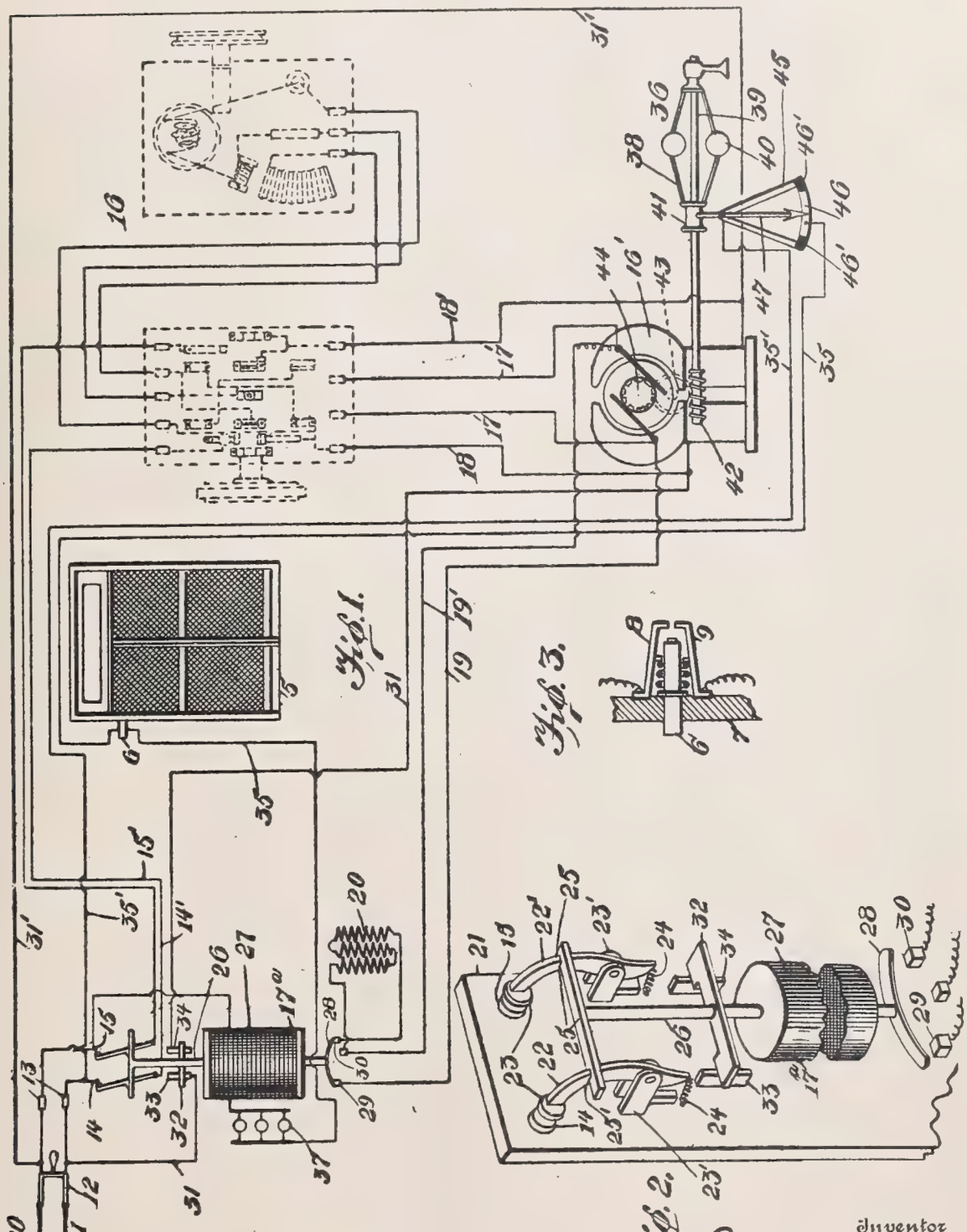

Fig. 1.

Fig. 3.

Fig. 2.

Witnesses:
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S. P. Montague

Inventor
John A. Miller
By Joseph W. Duell & Co
Attorney

Thurston - Baling

UNITED STATES PATENT OFFICE.

JOHN A. MILLER, OF BALTIMORE, MARYLAND, ASSIGNOR TO JOHN M. THURSTON, TRUSTEE, OF WASHINGTON, DISTRICT OF COLUMBIA.

SAFETY SYSTEM FOR MOTOR-PROPELLED CARS.

No. 823,478. Specification of Letters Patent. Patented June 12, 1906.

Application filed November 6, 1905. Serial No. 286,048.

To all whom it may concern:

Be it known that I, JOHN A. MILLER, a citizen of the United States, residing at the city of Baltimore, in the State of Maryland, have invented new and useful Improvements in Safety Systems for Motor-Propelled Cars, of which the following is a specification.

This invention relates to an improved safety system for motor-propelled cars or vehicles, and while capable of application to motor cars or vehicles of any type having safety closures or gates the invention possesses special utility as an electrical safety system for elevators.

To this end the invention contemplates a safety system or mechanism arranged to prevent the car from moving in the event of any of the safety doors or gates being opened, as well as providing means for arresting the car in the event of a safety door or gate becoming open during the travel of the car.

Also the invention comprises means for arresting the travel of the car in the event of the same attaining a dangerous speed.

A primary object of this invention is to provide a reliable method and means for the accomplishment of the above-mentioned purposes that is extremely simple in design and operation and comprises few working parts.

A further object of this invention is to provide an equipment that is adapted to be employed in connection with any type of electrically-actuated elevator and which is inexpensive to install and that employs but a small amount of electric energy to operate the same, thereby insuring the highest economy in construction, operation, and maintenance.

A further object of this invention is to provide a safety-governing means for a motor that is subject to the influence of a detecting-current in a normally closed safety-circuit in a manner whereby the said safety-governing means performs not only its special or intended functions, but is susceptible of revealing the failure of power or apparatus in said safety means—*i. e.*, any failure of power or apparatus in the safety means is indicated on the side of safety by reason of the actuation of the governing means and the consequent disconnection of the supply-current from the driving-motor and the application of the dynamic brake means employed.

To these ends the invention comprehends primarily an electrically-actuated switch mechanism included in a normally closed safety-circuit in a manner to be responsive to the opening of said circuit to cause the disconnection of the main or supply circuit to the motor, and the application of an electrodynamic brake for the purpose of holding the armature of said motor from movement.

This invention is especially applicable to the type of elevator in which the load is lifted by an electric motor and descends by gravity under the control of the same motor when the armature is reversed in direction of rotation.

Referring to the accompanying drawings, Figure 1 represents a diagrammatic view of the arrangement of the circuits and devices employed. Fig. 2 represents in perspective the electrically-actuated master-switch or safety-circuit controlled governing means. Fig. 3 represents a simple type of opening and closing attachment for doors employed in connection with the safety-circuit.

Like numerals indicate corresponding parts in the several figures.

Referring to the drawings by reference-numeral, 5 designates a sliding door that is intended to close a doorway or opening which leads into the elevator shaft or well (not shown) at an elevator-landing. A like door is provided at each of the various landings, said doors being disposed in the same vertical plane.

The safety-circuit closing and opening attachment 6 (shown enlarged in Fig. 3) is employed in connection with each door and comprises a spring-pressed pin 6′, that is supported for longitudinal movement in the frame 7 and which when pressed inwardly by reason of the contact of the adjacent edge of the closed door with the projecting end of said pin serves to force the opposite end to contact in bridging connection with the terminal contacts 8 and 9 of the said device to close the circuit at that point in the safety-circuit, which latter circuit will be hereinafter described.

The electric current for driving the elevator is taken from supply conductors or mains 10 and 11 through a manually-controlled double-pole switch 12. There is also included in said conductors 10 and 11 fuses 13. The conductors 10 and 11 terminate in fixed or stationary contacts 14 and 15, that are

shown as being electrically connected to a reversing-switch 16 through an interposed electrically-actuated switch device 17ª and conductors 14′ and 15′, while conductors 17 17′ and 18 18′ represent the armature and field-magnet circuits, respectively, that lead from the reversing-switch to the motor 16′.

The reversing or controlling switch 16 (shown in dotted lines in Fig. 1) being a well-known type and as its construction, arrangement, and scheme of circuits and connections with the motor form no part of this invention, it will be deemed unnecessary to describe the same.

The elevator-car (not shown) is adapted to be electrically propelled or driven by the motor 16′ through suitable cables and mechanism, while the starting and stopping of the motor is ordinarily effected by a cable operated from the car, which transmits a positive movement to the reversing-switch. (None of which parts are shown.)

The armature-circuit of the motor is divided into two branches or lines, one of which extends from the reversing-switch through conductors 17 17′, while the other normally open branch comprises conductors 19 19′, that include in one of said conductors resistance 20, the terminals of said circuit being arranged in operative relation with the master-switch 17ª.

Referring now particularly to the master-switch-controlling device 17ª, (see Fig. 2,) there is shown provided stationary contacts 14 and 15, the contact-faces of which are preferably composed of carbon and arranged in the same plane and which are properly spaced on a supporting board or base 21 and adapted to be engaged by the contact-faces of the movable switch mechanism for opening and closing of the supply-circuit that leads to the reversing-switch and motor.

The moving switch mechanism comprises a pair of switch-arms 22 22′, that are arranged in spaced parallelism and which carry on their free ends carbon contact-faces 23, that are adapted to engage with the corresponding contacts 14 and 15 when in a closed position. The arms 22 22′ are pivotally supported, respectively, on the brackets 23′, that project from the front of the board 21 and which form the terminals of the conductors 14′ and 15′, that lead to the reversing-switch 16. The switch-arms thus constructed and arranged are adapted to fall away from the contacts 14 and 15 by the force of gravity, which tendency is assisted by springs 24, operatively arranged, respectively, in connection with said arms, as shown. Provision, however, is made to normally maintain the switch-arms 22 22′ in a closed position by an electrically-operated detent means, which comprises a cross-arm 25, that is normally pressed upward against the shoulders 25′, formed on the respective arms, said cross-arm being in turn supported and carried on the upper end of the core or plunger 26, that is adapted for vertical reciprocation in the helix or solenoid 27. The lower end of the core 26 of the solenoid also supports a bridging contact-piece 28, that is adapted to contact in its lowermost position with the contacts 29 and 30, which form, respectively, the contact-terminals of the dynamic brake or armature short circuit. When the solenoid of the master-switch is deënergized, the core 26 is allowed to drop by gravity or by the exertion of spring force, or by both, to thereby break the supply-circuit and to cause at the same time the closing of the short circuit of the armature.

To provide a continuance of current-supply to the field-magnets of the motor 16′, a branch circuit formed of conductors 31 31′ lead independently from the main conductors 10 and 11 to the field-magnets of the motor in the manner shown and include a bridging contact-piece 32, that is carried by the core 26 of the master-switch and which slides on the contact-blocks 33 and 34 during the reciprocation of said core 26. Thus it will be seen that a very effective kind of dynamic brake may be obtained by the disconnection of the supply-main from the motor and the introduction of a short circuit to the armature of the motor, providing the said short circuit includes a proper amount of resistance and a suitable quantity of current is allowed to pass to the field-magnets after the regular main supply of current has been cut off. I will now describe the means for energizing and deënergizing the solenoid of the master-switch. The operating-coil 27 is shown as being included in a subsidiary or safety circuit, that comprises conductors 35 35′, which include in circuit at the respective door-landings the door opening and closing attachments 6 and at a point adjacent to the motor the speed-limit-governing means 36 for said motor. The conductors 35 and 35′ are shown as being connected to main feed-conductors 10 and 11. It will therefore be observed that so long as the safety-circuit just referred to is closed the solenoid will remain energized and the core thereof will maintain a closure of the motor-feed circuit and a break in the dynamic brake or short-circuit of the armature, whereas upon the deënergization of said solenoid by reason of the opening of the safety-circuit the motor-feed circuit will be automatically disconnected and the armature short circuit will be established.

37 designates a bank of lamps that are included in the safety-circuit and which serve not only to indicate the current strength in said circuit, but which prevent sparking at the points where said circuit is opened. The safety-circuit is shown as also including a circuit-opening device operated by a centrif-

ugal governor 36, which also serves to actuate the master-switch in the event of the motor attaining a dangerous speed. The centrifugal governor device consists of governor-springs 38, mounted on a horizontal shaft 39, said springs carrying the usual central balls 40. One end of this governor is attached firmly to the shaft, while the other end is connected to a sliding collar 41. The shaft 39 is provided on its extended portion with a worm-gear 42, that in turn meshes with a gear-wheel 43. The gear 43 is positioned to engage with the gear-wheel 44, mounted on the end of the armature-shaft, as shown.

45 designates a sector the face of which is provided with a centrally-arranged contact portion 46 and insulated strip portions 46′, arranged as shown, the same being disposed in range and directly beneath the pathway and in contact with a pivoted lever 47, that is fulcrumed to the sector. The opposite end of the lever 47 is operatively connected to and controlled by the sliding collar 41 of the governor.

By reason of the foregoing-described arrangement a speed-limiting means is provided for the motor that serves to open the safety-circuit when the speed of the armature reaches a dangerous point when traveling in either direction.

The operation of the safety devices will be readily understood from the foregoing description.

What I claim as new and useful is—

1. In a safety system of the class described, the combination with a motor and its independent controlling means, of a separate safety-circuit, an armature short circuit, opening and closing means for the safety-circuit independent of said motor-controlling means, and switch mechanism comprising means for opening and closing the motor-supply circuit, and for the reverse opening and closing of said short circuit.

2. In a safety system of the class described, the combination with a motor and its independent controlling means, of a motor-supply circuit, speed-governing means for the motor, a separate safety-circuit including said speed-governing means, opening and closing means for the safety-circuit independent of the said motor-controlling means, and means also included in the safety-circuit for controlling said supply-circuit and for applying a dynamic brake to the motor.

3. A safety system of the class described comprising a motor-supply circuit, a normally closed safety-circuit, opening and closing means included in said circuit, a current-indicator and spark-preventing means included in said circuit, and an electric switch arranged in operative relation to said safety-circuit and provided with means for opening and closing an armature short circuit for the motor.

4. A safety system of the class described comprising a supply-circuit for a motor, an armature short circuit therefor, an independent field-circuit for the motor, means for opening and closing said supply-circuit, means for causing the reverse opening and closing of the short circuit, and means for establishing the independent field-circuit to the motor.

5. In a safety system of the class described, the combination with a motor and its independent controlling means, of a motor-supply circuit, an armature having a plurality of circuits, one of which circuits is normally open and provided with resistance, a switch in each circuit for controlling the same independently of said motor-controlling means, and means for actuating the switches.

6. A safety system of the class described comprising a motor-supply circuit, a normally energized magnetic switch normally maintaining the current-supply for the motor, an armature branch short circuit including said switch and adapted to be closed upon the deënergization of the latter, a current-retaining circuit for the motor field-magnets, and means for energizing and deënergizing the magnetic switch from a remote point.

7. A safety system of the class described comprising a motor-supply circuit, an armature short circuit, an independent field-circuit, a separate safety-circuit, a switch included in said safety-circuit and comprising means for opening and closing the supply-circuit, for causing the reverse opening and closing of the armature short circuit, and for establishing said independent field-circuit for the motor, and a door or gate actuated circuit opening and closing means included in said safety-circuit.

8. A safety system of the class described comprising a supply-circuit for a motor, an armature short circuit, an independent field-circuit, a separate safety-circuit, motor-governing means included in said safety-circuit, and a switch also included in said safety-circuit and comprising means for controlling all of said other circuits, and controlled itself by said governing means.

9. A safety system of the class described comprising a motor-supply circuit, an armature short circuit, a current-retaining branch for the field-magnets of the motor, a safety-circuit, a switch mechanism included in said safety-circuit and comprising means for controlling said other circuits, means independent of the usual motor-controlling means for opening and closing the safety-circuit, and a speed-governor included in the said safety-circuit and operatively related to said motor.

10. A safety system of the class described comprising a motor-supply circuit, a safety-circuit, motor-governing means included in said safety-circuit, a switch mechanism also included in said circuit and comprising means

for opening and closing the motor-supply circuit, an electrically-operated detent arranged in operative relation to said governing means for normally holding the switch mechanism in a closed position, and motor-armature short-circuit connections arranged to be controlled by said detent.

11. In a safety system for motor-propelled vehicles having a safety-closure and independent motor-controlling means, the combination of a safety mechanism having a controlling device operated solely from said closure and comprising means, independent of said motor-controlling means, for opening and closing the power-supply for the motor, and for simultaneously applying restraining means to the latter.

In testimony whereof I affix my signature in presence of two subscribing witnesses.

JOHN A. MILLER.

Witnesses:
G. P. MONTAGUE,
H. M. STERLING.

No. 830,944. PATENTED SEPT. 11, 1906.

J. J. WESTBROOK.

SLACK CABLE STOP FOR ELEVATORS.

APPLICATION FILED MAY 4, 1906.

3 SHEETS—SHEET 1.

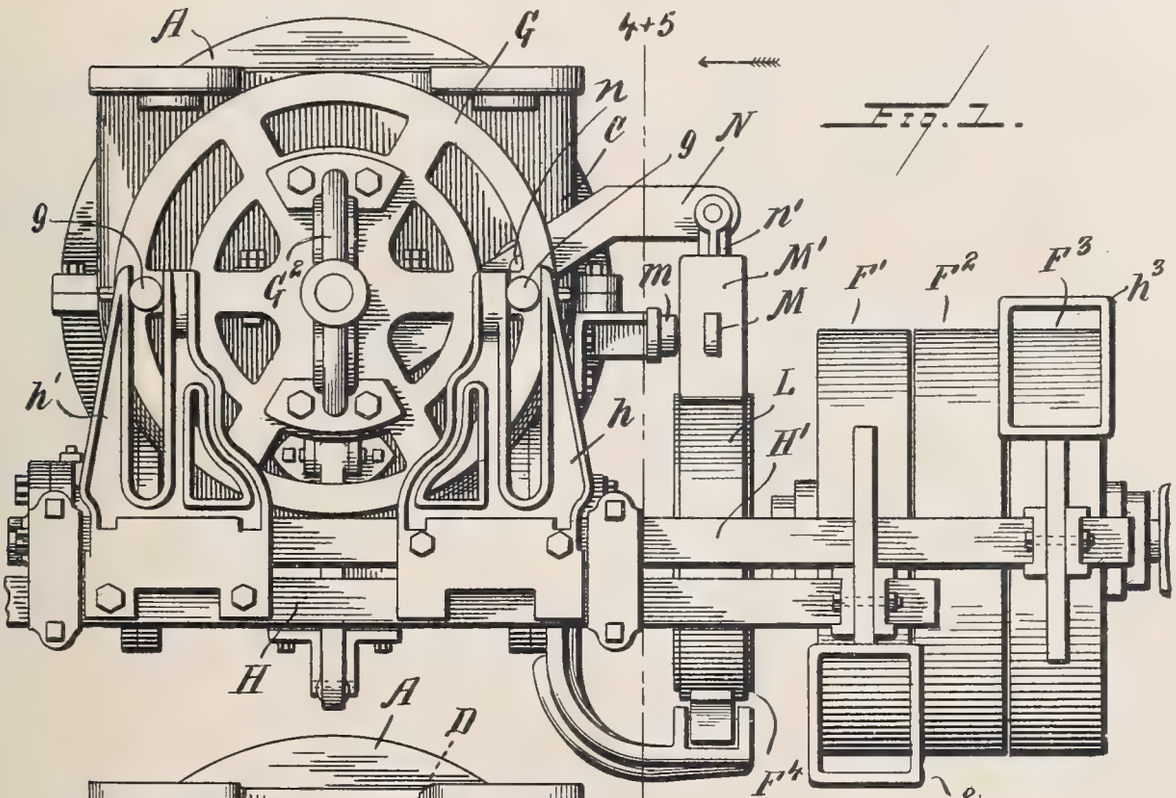

Fig. 1.

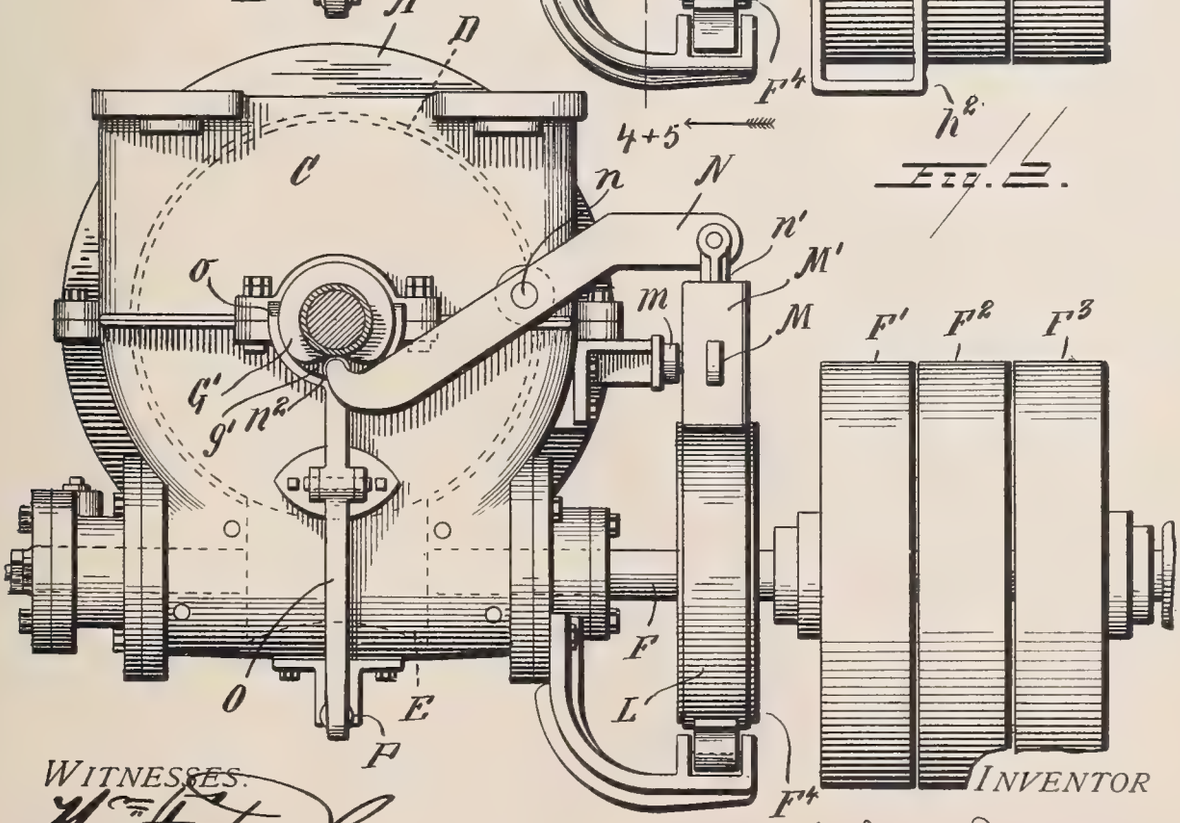

Fig. 2.

WITNESSES.

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3 SHEETS—SHEET 2

Fig. 5.

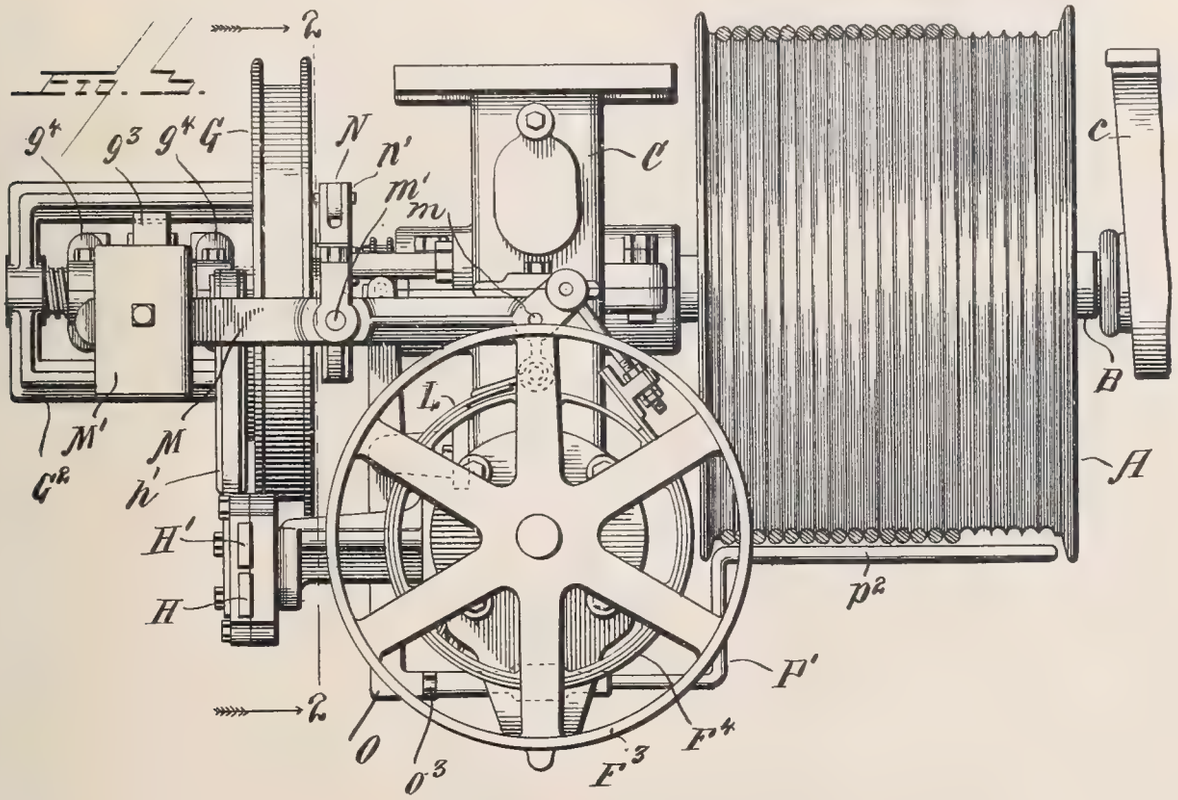
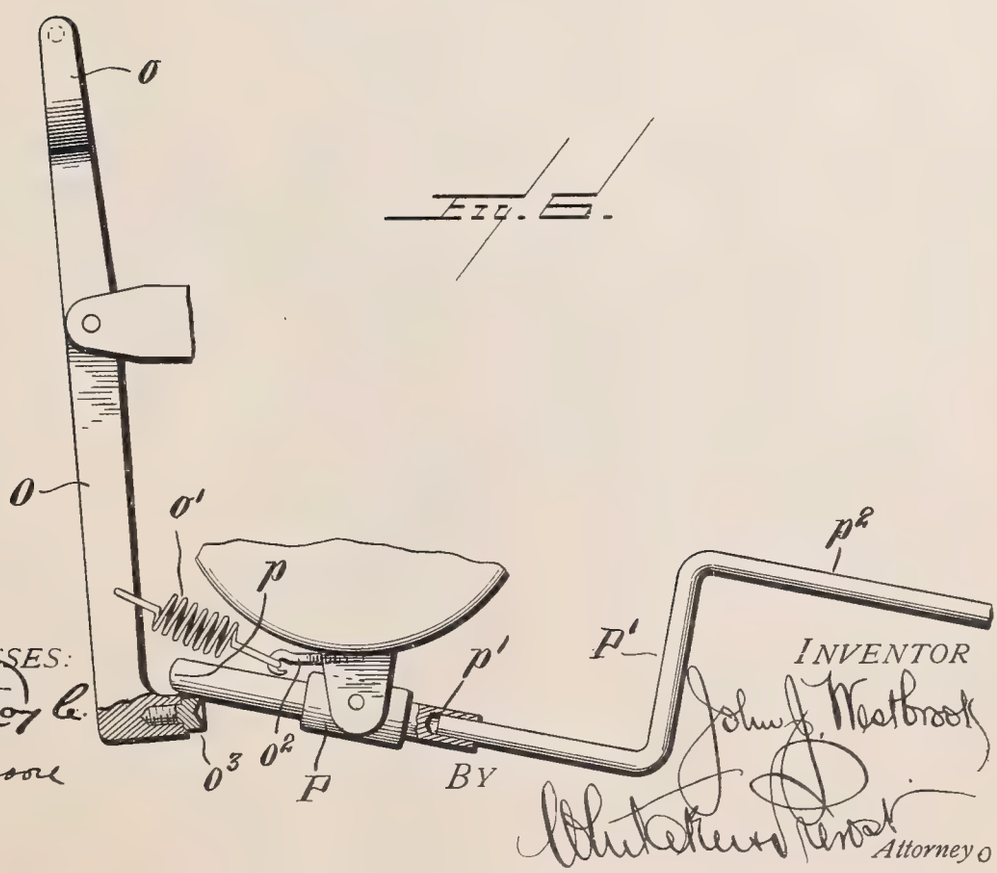


Fig. 6.



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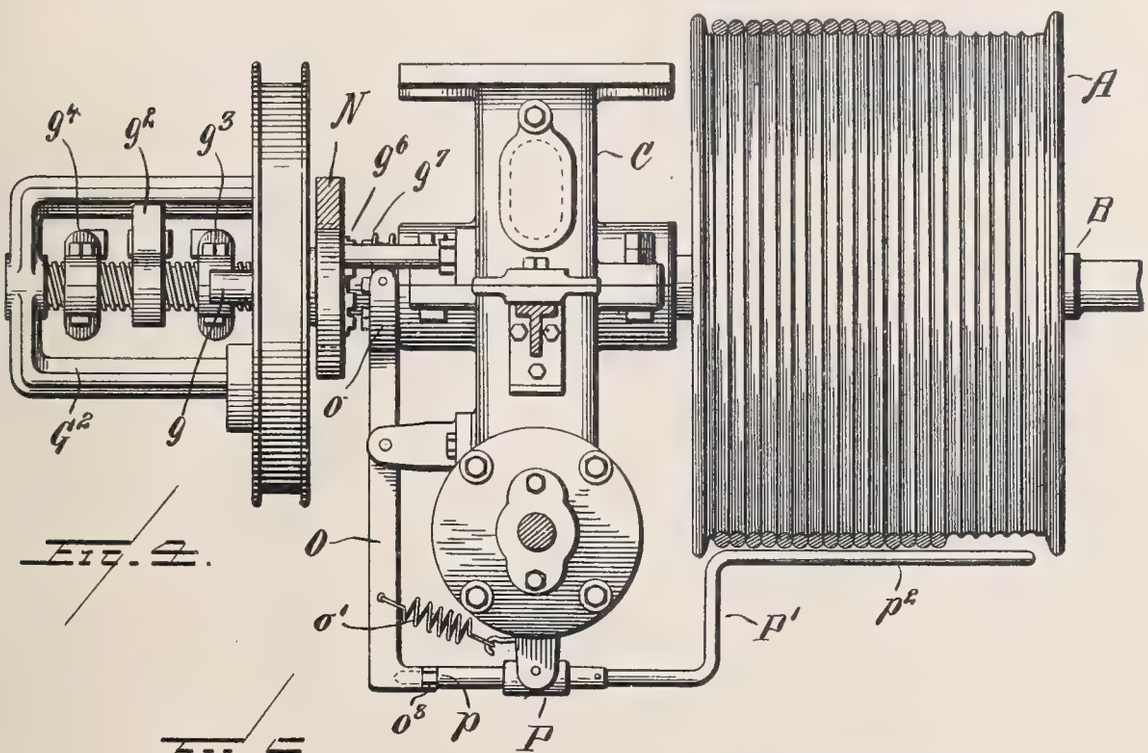

Fig. 4.

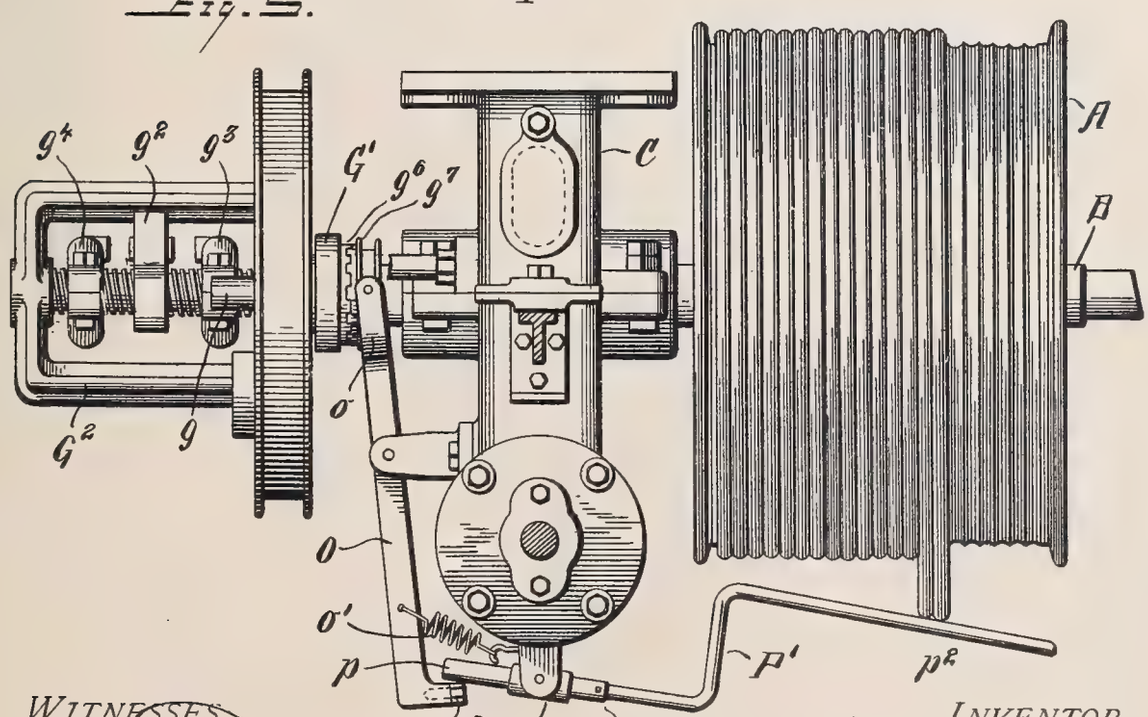

Fig. 5.

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UNITED STATES PATENT OFFICE.

JOHN J. WESTBROOK, OF DANVILLE, VIRGINIA.

SLACK-CABLE STOP FOR ELEVATORS.

No. 830,944. Specification of Letters Patent. Patented Sept. 11, 1906.

Application filed May 4, 1906. Serial No. 315,197.

To all whom it may concern:

Be it known that I, JOHN J. WESTBROOK, a citizen of the United States, residing at Danville, in the county of Pittsylvania and State of Virginia, have invented certain new and useful Improvements in Slack-Cable Stops for Elevators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention consist in the novel features hereinafter described, reference being had to the accompanying drawings, which illustrate one form in which I have contemplated embodying my invention, and said invention is fully disclosed in the following description and claims.

Referring to the drawings, Figure 1 represents a side elevation of a winding mechanism for elevators embodying my invention. Fig. 2 is a sectional view taken transversely of the drum-shaft in rear of the flier-wheel, as indicated by line 2 2 in Fig. 3. Fig. 3 is a front elevation of the mechanism. Fig. 4 is a sectional view on line 4 4 of Fig. 1. Fig. 5 is a sectional view on line 5 5 of Fig. 2. Fig. 6 is an enlarged detail of the slack-cable-operated lever, the clutch-operating lever, and the operating-spring for the latter.

The object of my invention is to provide a simple and efficient mechanism for stopping the elevator-operating mechanism in case the car or the counterweight in its descent encounters an obstacle which arrests it. The result of the stoppage of the car is that the supporting cable or cables will continue to unwind if the operating mechanism be not thrown out of operation, and should the weight of the car overcome the obstruction and fall the shock would in most cases break the cable and cause the car to plunge to the bottom of the shaft.

By my invention I provide a construction by means of which the operating mechanism will be stopped almost instantly in case the downward movement of the car is arrested or in case for any other reason the suspending-cable becomes slack, and the mechanism is so constructed that it can be readily adapted to drums of different diameters or width of face and applied to different types of elevators having a winding-drum without altering the main elements of the mechanism, as will hereinafter more fully appear.

In the drawings I have shown a belt-driven winding mechanism for elevators with which my improved slack-cable device is preferably employed; but it may also be used with other forms of winding mechanism, such as electrically-operated elevators, &c.

In the apparatus shown, A represents the winding-drum mounted on the drum-shaft B, which is supported in bearings in the casing C and in an exterior bearing *c*, said bearing and casing being preferably supported from suitable overhead beams or girders in any desired manner. Within the casing C is a worm-wheel D, (indicated in dotted lines in Fig. 2,) mounted on shaft B and engaging a worm E, (also indicated in Fig. 2 in dotted lines,) mounted on the driving-shaft F, which is mounted in suitable bearings provided in the casting and is provided with three pulleys F′ F² F³. The central pulley F² is fast on the shaft, and the two other pulleys are loose and are adapted to be driven in opposite directions by belts which may be shifted onto the fast pulley to drive the apparatus in either direction.

The belt-shipping apparatus comprises a "flier-wheel" G, mounted loosely on the drum-shaft B and provided on its outer face with oppositely-disposed studs (or friction-rolls) *g*, engaging slots in brackets *h h′*, secured, respectively, to sliding shipper-bars H H′. The bar H carries a belt-shipper h^2 for pulley F′, and the bar H′ carries a belt-shipper h^3 for pulley F³. It will thus be seen that the movement of the flier-wheel in either direction will operate one of the belt-shippers and start the mechanism in one direction, and the movement of the flier-wheel back to the position shown in Fig. 1, which I will term "median position," will throw whichever belt was upon the fast pulley back upon its loose pulley and stop the apparatus. The operation of the flier-wheel also throws into and out of operation a brake mechanism to secure a prompt stopping of the mechanism and prevent it from continuing its operation by inertia. The driving-shaft F is provided with a brake-wheel F⁴, around which is a brake-band L, operatively connected to the brake-lever M, which is pivoted near one end at *m* to the casing and is provided at its opposite or outer end with a weight M′, tending to apply the brake.

N is a brake-controlling lever pivoted near its center at *n* to the casing C and having its upper end connected by a link *n′* to the brake-lever M at *m′* and its lower end pro-

vided with a friction-roll n^2, which engages a cam G′, forming part of or connected operatively with the flier-wheel G. This cam has a recess g', which engages the roll n^2 when the flier-wheel is in its median position, thus allowing the weight M′ on brake-lever M to apply the brake. When the flier-wheel is turned in either direction, the roller n' rides up a cam-grade, thus lifting the brake-lever M and releasing the brake.

The flier-wheel is provided with a yoke G^2 for guiding a traveling block g^2 on a threaded portion of the drum-shaft, and upon said threaded portion are clamped the usual automatic stops g^3 g^4 for throwing the flier-wheel when the elevator-car reaches the top or bottom of the shaft.

The flier-wheel or some part connected therewith (in this instance the cam G′) is provided with a clutch member, (indicated at g^6,) and a movable clutch member g^7 is arranged adjacent thereto and is preferably mounted on a spline or feather on the shaft B.

O represents a pivoted clutch-operating lever provided at its upper end with a yoke o, engaging the movable clutch member g^7 and provided adjacent to its lower end with a spring o', which tends to throw the movable clutch member into engagement with the clutch member carried by the flier-wheel. This spring is connected to an adjustable screw-hook o^2 or other device by means of which its tension may be adjusted.

Adjacent to the lower end of the clutch-lever O, I provide a trip-lever P, pivoted to a stationary part of the apparatus (in this instance the casing C) and so constructed that the lever O can be moved so as to separate the clutch members g^6 g^7 and locked in that position by the trip-lever P. To provide for a practically instantaneous disengagement of the parts O and P, I prefer to provide one with a concave socket to engage a convex portion of the other, so that when they have been moved slightly out of engagement the pressure of the spring o' will cause them to separate quickly. In this instance I have shown the lever O provided with an angular projection at its lower end, which carries an adjustable screw o^3, the head of which is recessed or concave, and the end p of the trip-lever P is convex or rounded to engage this recess in the screw o^3.

The lever P is preferably formed of cast-iron and is provided at the end opposite that which engages the clutch-lever with a recess p' to receive a trip-arm P′, which I form, preferably, of wrought-iron and which is made to conform to the particular winding-drum with which it is to be used. The trip-arm P′ has a portion p^2, which extends across the lower portion of the face of the drum between the flanges and lies as closely as possible to the cable-coils thereon as is possible without touching them, as shown in Figs. 3 and 4. The trip-arm P′ is secured to the trip-lever P by inserting it in the recess p' of the latter and securing it by a set-screw p^3.

It will be noted that by making the trip-lever P and trip-arm P′ separately the trip-lever and the clutch-lever O can be made of one size and pattern for all sizes of machines, and the trip-arm can be bent to the proper form to suit the particular drum with which it is to be used and then secured to the trip-lever.

By reference to Fig. 5 it will be seen that should the cable become slack for any reason, as by the arresting of the car in its downward movement, the weight of any slack coil will depress the trip-arm P′ and instantly disengage the trip-lever P and clutch-operating lever O, when the spring o' will cause the clutch-lever to throw in the clutch member g^7 and operate the flier-wheel in the direction in which the drum-shaft is moving at the time, thus returning the flier-wheel to median position, and thereby, as previously described, throwing off the driving-belt to its loose pulley and allowing the brake to be applied, thus almost instantaneously stopping the mechanism and preventing the unwinding of the cable. After the slack-cable stop mechanism has been operated it is necessary to pull out the lower end of clutch-lever, reverse the travel of the winding mechanism until the slack is taken out of the cable, when the trip-the lever P may be placed in engagement with clutch-lever and will hold it out of operation until the cable again becomes slack. Should the counterweight of the elevator meet any obstruction in its descent or should the trip-arm P′ through any cause or by accident become disengaged from the clutch-operating lever O, the clutch-lever will be thrown over by spring o' and operate the belt-shippers, as previously described, or, in other words, this slack-cable-stop mechanism will stop the mechanism when the car is moving either up or down should the trip-arm P′ be tripped.

While I have shown my invention applied to one form of double belt-elevator-winding mechanism, it may also be used in connection with other forms than that shown, and it can also be used with single belt-winding mechanism and with direct-connected engine-winding mechanisms by simply varying the connections from the flier-wheel which serve to shut off or disconnect the power. This invention is also applicable to electric elevators, in which case the flier-wheel instead of being operatively connected to belt-shipping mechanism, as herein shown, is connected with an electric controller for the motor which actuates the winding-drum.

What I claim, and desire to secure by Letters Patent, is—

1. In a slack-cable stop for elevator mechanism, the combination with the flier-wheel, a clutch mechanism therefor provided with a

movable member, a clutch-operating lever connected with said movable clutch member, a spring for moving said movable member into operative position and a trip-lever having a part engaging said clutch-lever and a part in position to be engaged by a slack portion of the cable, substantially as described.

2. In a slack-cable stop for elevator mechanism, the combination with the flier-wheel, a clutch mechanism therefor provided with a movable member, a clutch-operating lever connected with said movable clutch member, a spring for moving said movable member into operative position and a trip-lever having a part engaging said clutch-lever, and a part in position to be engaged by a slack portion of the cable, the engaging portions of said trip-lever and clutch-lever being the one convex and the other concave, to form a socket to receive said convex part, substantially as described.

3. In a slack-cable stop for elevator mechanisms, the combination with the flier-wheel, a clutch mechanism therefor provided with a movable member, a clutch-operating lever connected with said movable clutch member, a spring for moving said movable member into operative position and a trip-lever having a part engaging said clutch-lever, and a separate trip-arm having a portion arranged in position to be engaged by a slack portion of the cable, and rigidly secured to said trip-lever, substantially as described.

4. In a slack-cable stop for elevator mechanisms, the combination with the flier-wheel, a clutch mechanism therefor provided with a movable member, a clutch-operating lever connected with said movable clutch member, a spring for moving said movable member into operative position and a trip-lever having a part engaging said clutch-lever and having a recess in its opposite end, a separate trip-arm having a portion constructed to lie within the flanges of the winding-drum of the elevator mechanism, and having its opposite end secured in the recess in said trip-lever, substantially as described.

5. In a slack-cable stop for elevator mechanism, the combination with the flier-wheel, a clutch mechanism therefor provided with a movable member, a clutch-operating lever connected with said movable clutch member, a spring for moving said movable member into operative position and a trip-lever having a part engaging said clutch-lever and a part in position to be engaged by a slack portion of the cable, one of the engaging portions of said trip-lever and clutch-lever being adjustable with respect to the part to which it is secured, substantially as described.

6. In a slack-cable stop for elevator mechanism, the combination with the flier-wheel, a clutch mechanism therefor, a clutch-operating lever, a spring connected therewith for throwing the clutch mechanism into operative position, said lever being provided with an adjustable screw having a concave seat, a pivoted trip-lever having a convex portion for engaging said concave seat to hold the clutch-lever and clutch out of operative position, said lever being provided with a recess at its other end, and a trip-arm having a part engaging said recess and a part bent to extend across the face of the winding-drum of the elevator mechanism and between the flanges thereof, substantially as described.

In testimony whereof I affix my signature in the presence of two witnesses.

JOHN J. WESTBROOK.

Witnesses:

W. J. Westbrook,

Stanley W. Scott.

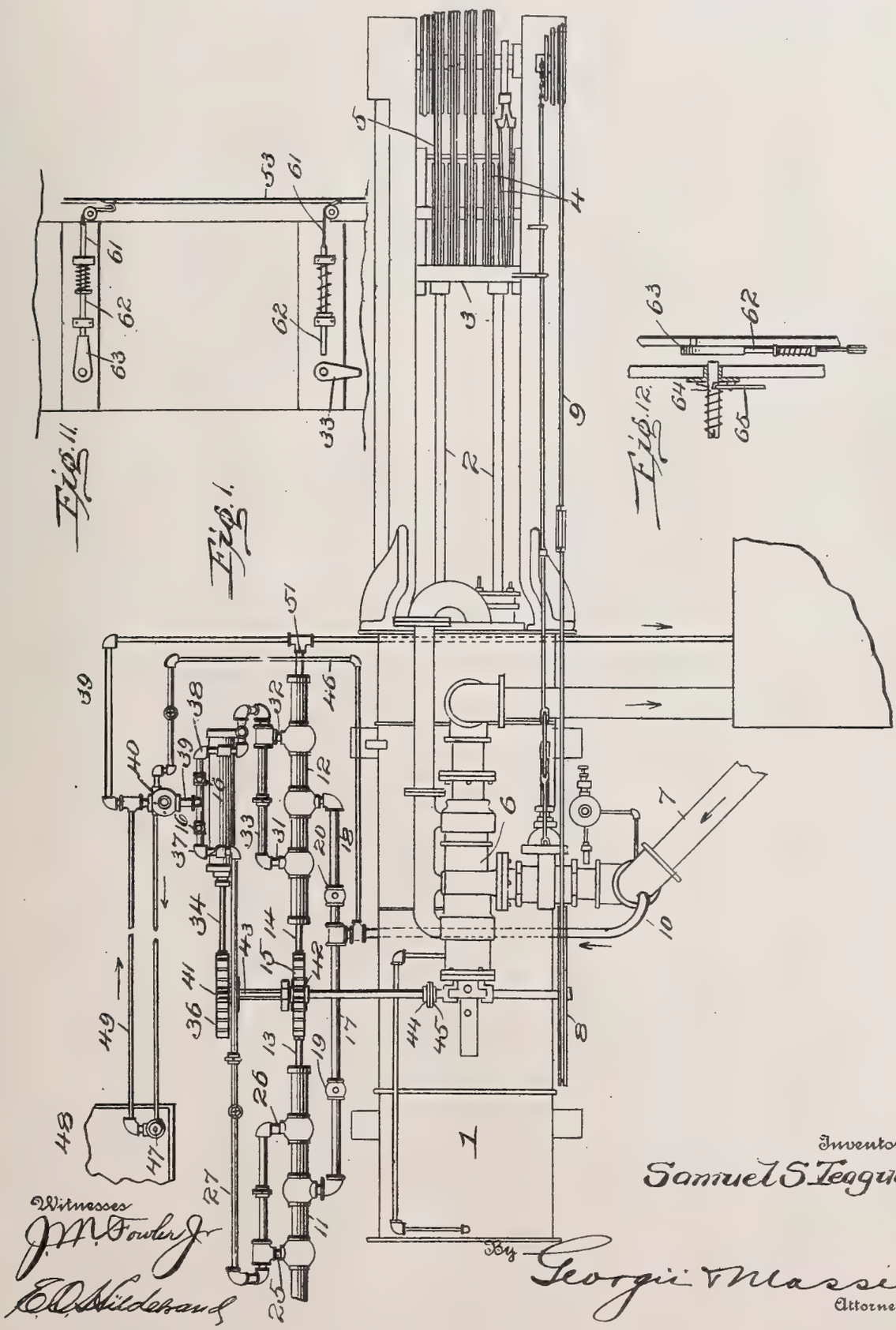
No. 852,357. PATENTED APR. 30, 1907.

S. S. TEAGUE.

AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

APPLICATION FILED MAY 16, 1906.

5 SHEETS—SHEET 1.



THE NORRIS PETERS CO., WASHINGTON, D. C

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S. S. TEAGUE.

AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

APPLICATION FILED MAY 16, 1906.

5 SHEETS—SHEET 2.

Fig. 2.

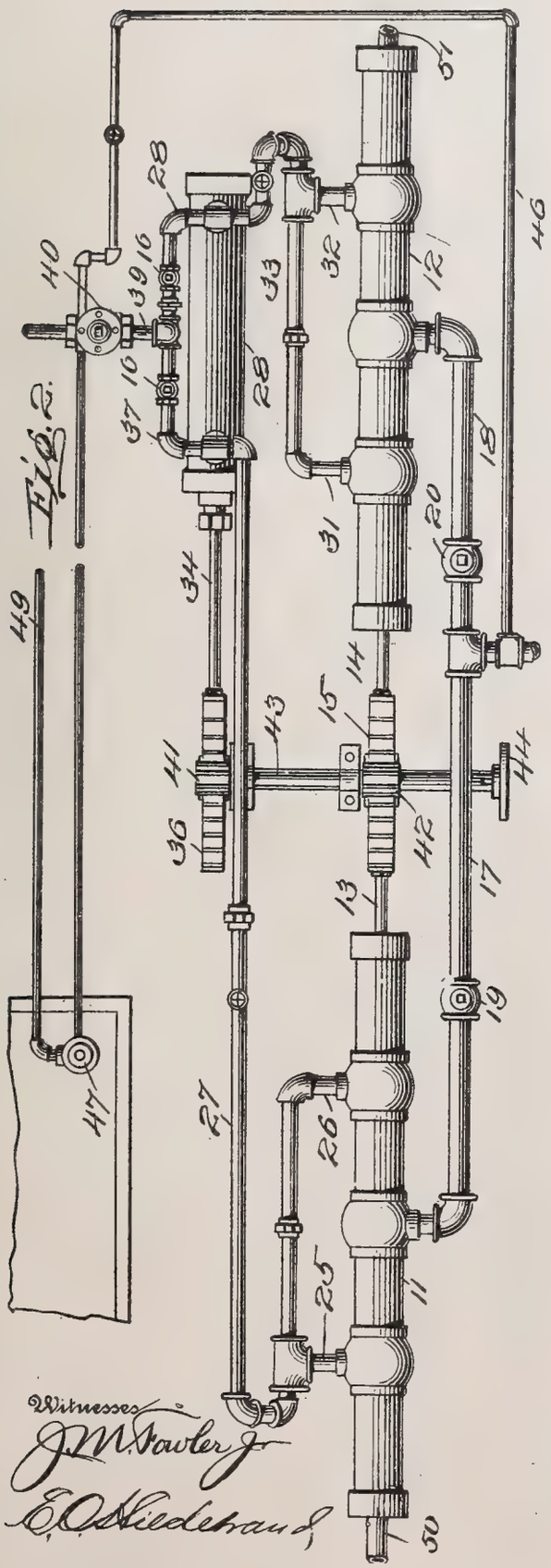
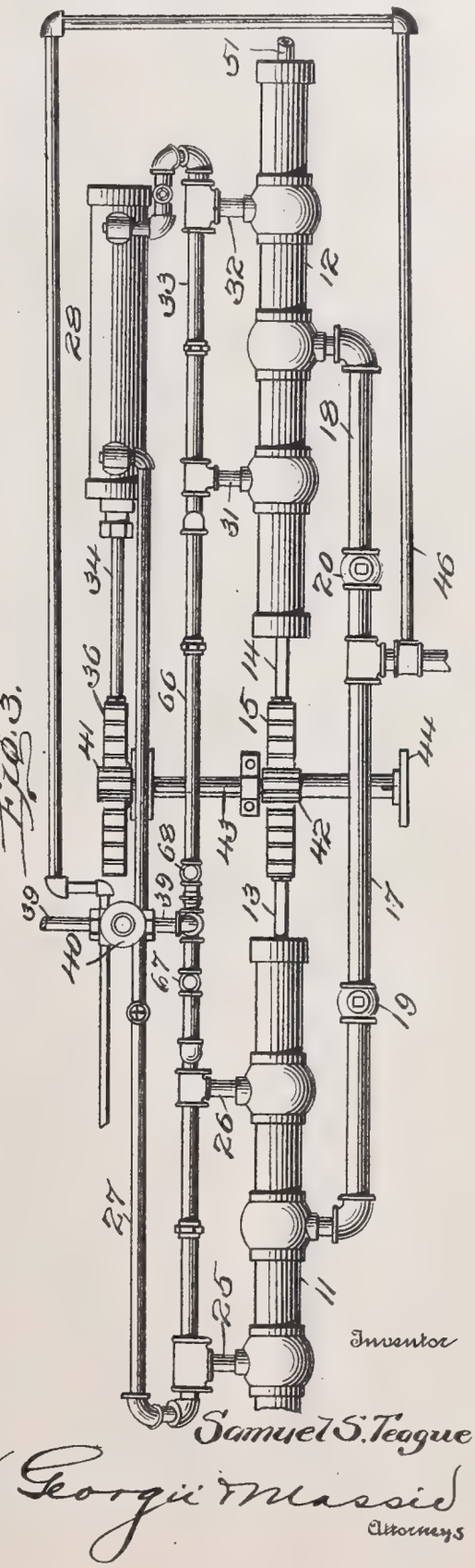


Fig. 3.



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AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

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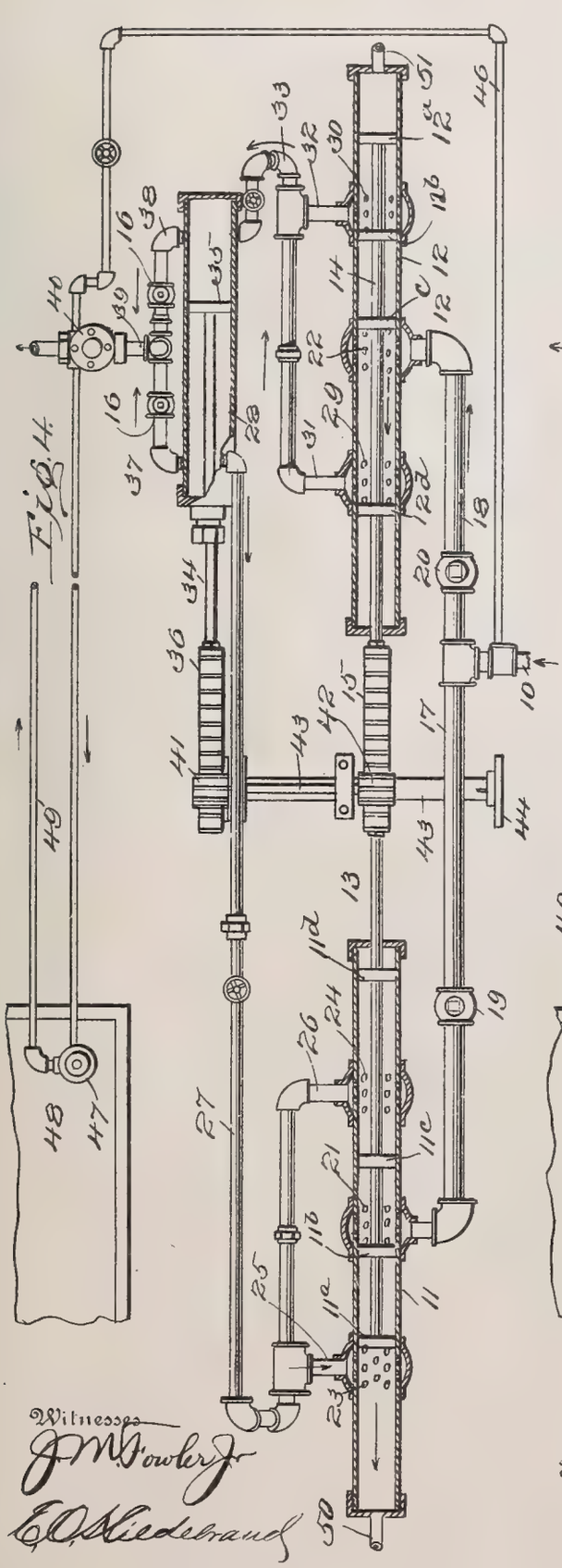

Fig. 4.

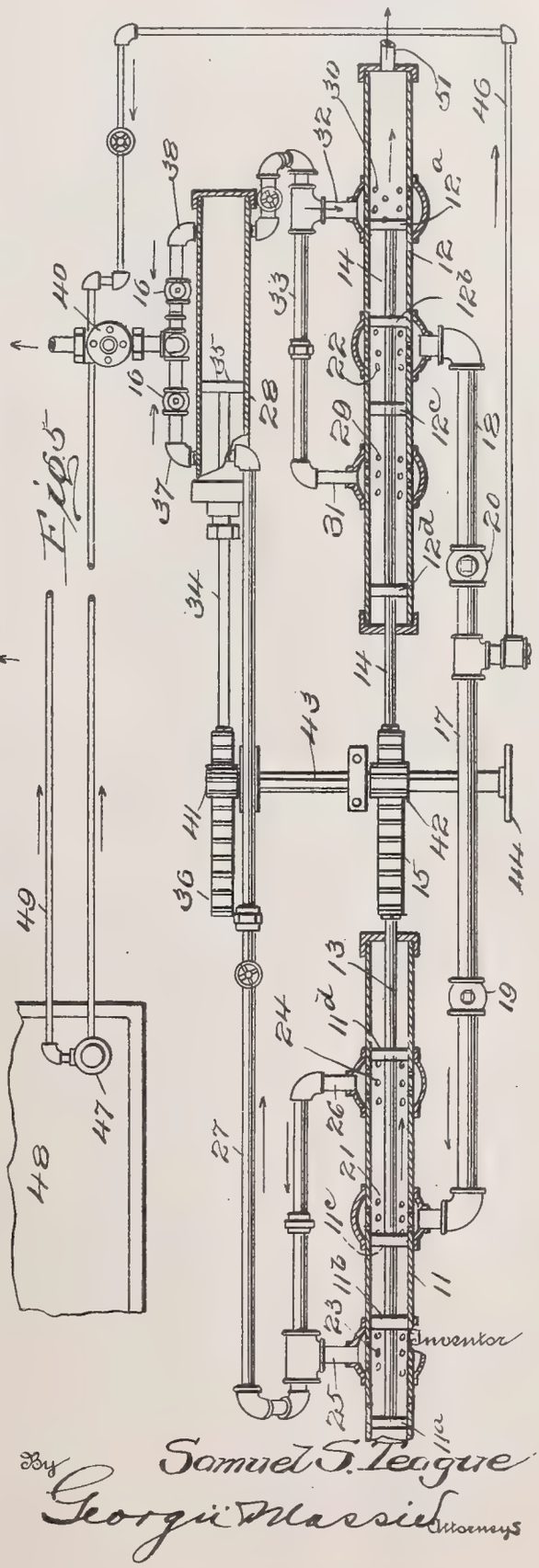

Fig. 5.

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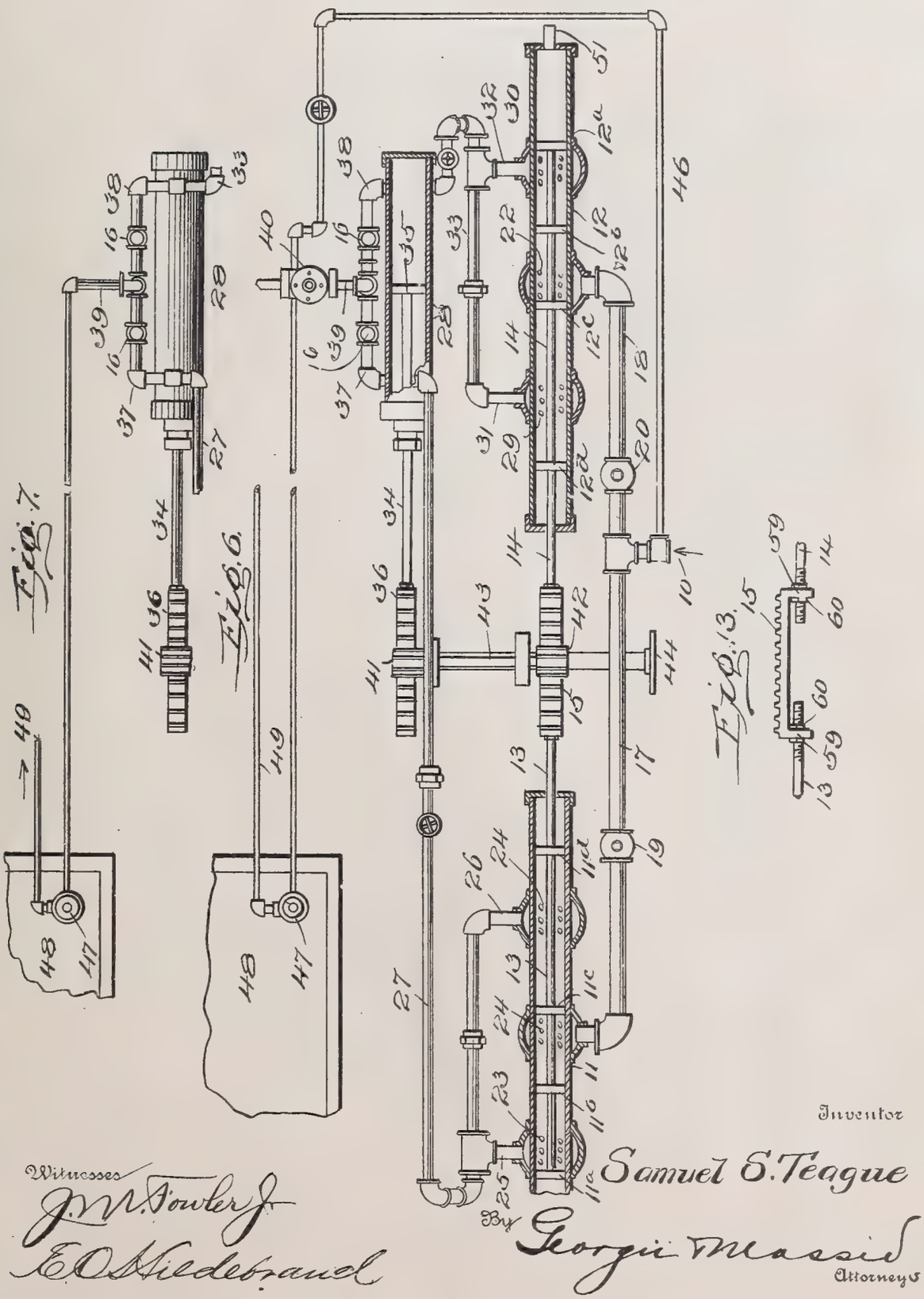
AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

APPLICATION FILED MAY 16, 1906.

5 SHEETS—SHEET 4.



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No. 852,357. PATENTED APR. 30, 1907.

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AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

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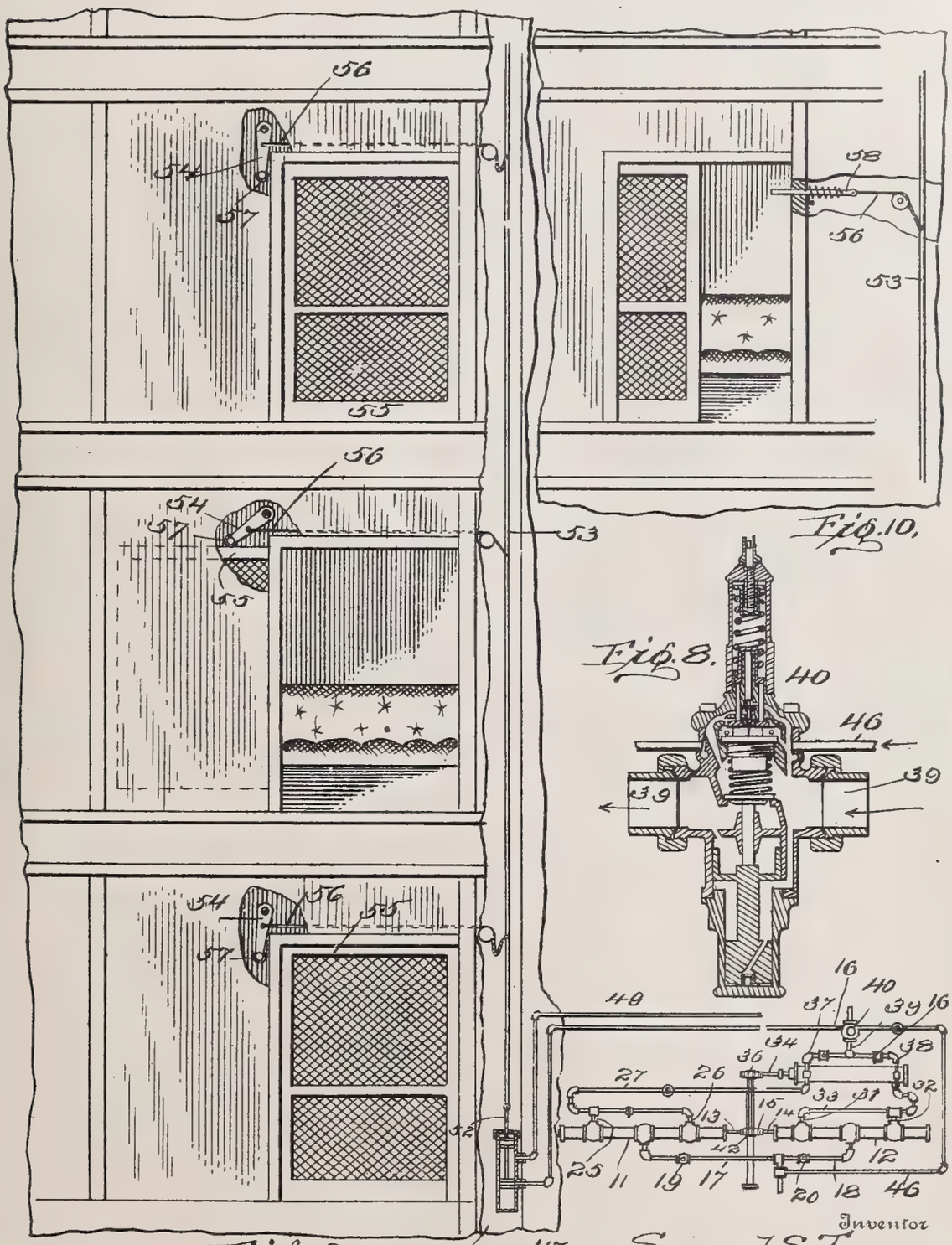

Fig. 9.

Fig. 10.

Fig. 8.

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AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

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To all whom it may concern:

Be it known that I, SAMUEL S. TEAGUE, engineer, a citizen of the United States, residing at 936 E street northwest, Washington, District of Columbia, have invented certain new and useful Improvements in Automatic-Control Devices for Elevators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to automatic control devices for elevators and has for its object means by which the operation of the elevator is automatically controlled by the opening and closing of the elevator door. In devices of this general character, it is old to provide means whereby the elevator having been stopped at a particular landing and the door opened, a start cannot again be made until the door is closed; also to provide means such as counterweights or springs whereby when the operating lever is released, it will return to its inoperative position; also to provide for the shutting off of the water supply to the operating cylinder upon the opening of the elevator door or similar contingency. As distinguished from these, my invention provides that upon the opening of the elevator door, for instance, means are set in motion whereby through hydraulic pressure, the shipper mechanism is itself thrown to an inoperative position and there locked until the door be closed.

The invention consists, moreover, in certain features of construction whereby the different elements co-operate to secure the desired result in a perfectly automatic and entirely certain and efficient manner.

The invention, as hereinafter more fully described and as particularly set out in the claims, will be readily understood from an inspection of the accompanying drawings setting forth a preferred embodiment of the same and modifications.

In these drawings Figure 1 is a general view of the device assembled in connection with the operating cylinder of an elevator; Fig. 2 is a plan view of the same disconnected; Fig. 3 is a modification; Fig. 4 is a horizontal section through the valve mechanism shown in Fig. 2 in one position of operation; Fig. 5 is a similar view to Fig. 4 in the other extreme position of operation; Fig. 6 is a similar view at an intermediate position; Fig. 7 is a further modification; Fig. 8 is a detail view of a regulating valve employed; Fig. 9 is a view showing an operative connection between the device and the elevator doors; Fig. 10 shows a modified form of connection from that shown in Fig. 9; Fig. 11 is a detail view showing a trip mechanism; Fig. 12 is a plan view showing a connection between the trip and its operating device; and Fig. 13 is a detail of the rack adjustment.

While the invention may be readily applied to any ordinary form of elevator, I have illustrated and will describe the same as connected with a hydraulic elevator.

The main operating cylinder or motor 1 containing the usual pistons operating, by and through the piston rods 2 and the cross head 3, upon the sheaves 4 to communicate motion by means of the ropes 5 to the elevator car in a well known manner, is supplied with water through the main or operating valve 6 of ordinary construction from a pressure tank (not shown) by means of a pipe 7. This operating valve is manipulated in the well known way from a pulley 8 operated from the car by the shipper rope 9. The manipulation of this operating valve might be effected by means of levers, rods or any other well known structure, the term "shipper mechanism" being used hereinafter to embrace any means for controlling the motor from the car to start and stop the elevator.

A fluid pressure pipe 10 tapping the supply from the pressure tank leads to an auxiliary valve mechanism forming a part of my invention and composed, preferably, of twin valves 11 and 12, the stems 13 and 14 of which are adjustably connected to the rack 15 and provided with disks 11^a, 11^b, 11^c and 11^d and 12^a, 12^b, 12^c and 12^d respectively. The connection between the pressure pipe 10 and the auxiliary valve mechanism is by means of branches 17 and 18 containing check valves 19 and 20 permitting of a flow in a forward direction only, the branches 17 and 18 communicating with the respective valves 11 and 12 by ports 21 and 22. The two ports 23 and 24 of the valve 11 lead by way of the branches 25 and 26 of the pipe 27 to one end of a valve motor 28 while the ports 29 and 30 of the valve 12 lead by way of branches 31 and 32 of the pipe 33 to the

opposite end of the valve motor 28. By the stem 34 of the valve motor 28 is carried a disk 35, and to the stem 34 is likewise adjustably secured a rack 36. Pipes 37 and 38 each containing a check valve as shown, lead from the opposite ends of the valve motor 28 to a discharge pipe 39 containing a regulating valve 40 to be hereinafter more particularly described.

The rack 36 attached to the valve stem 34 and the rack 15 connecting the valve stems 13 and 14 are respectively in engagement with pinions 41 and 42 keyed to a common spindle 43 rigidly connected by a coupling member 44 with a similar coupling member 45 fixed upon the spindle of the shipper mechanism, which spindle controls the main valve 6, wherefore it will be seen that any movement of the auxiliary valves will be positively transmitted to the shipper mechanism and also to the operating valve.

A small pipe 46 leads from the pressure pipe 10 by way of the regulating valve 40 to a control valve 47 located adjacent to the lower portion of the elevator shaft 48 from whence a waste pipe 49 leads to the discharge pipe 39 and thence to the open tank. Waste pipes 50 and 51 likewise lead to the same point of discharge.

The control valve 47, shown in section in Fig. 10, is a simple balanced valve having an inlet from pipe 46 and an outlet to pipe 49 with spaced disks so arranged that in the upper position the lower disk closes the inlet and in the lower position the inlet and outlet communicate by means of the space between the disks. The stem and disks of this valve are raised to close the same in the manner hereinafter described and they return to the normal open position of their own weight.

The regulating valve 40, preferably used, is of the Mason type shown in detail in Fig. 8, although other regulating valves of known construction might be employed. The construction of this valve is well known to be such that the passage of fluid therethrough by the pipe 39 is controlled by the pressure in the pipe 46, wherefore if, by the closing of the valve 47, the pressure in the pipe 46 is increased, the regulating valve 40 closes the discharge 39.

Attached to the stem 52 of the valve 47 is a cord or rope or rod 53 extending upward through the elevator shaft. Levers 54, pivoted above the doors 55, are connected to the cord 53 by cords 56. The free end of the levers 54 is provided with an anti-friction roll 57 arranged to ride upwardly upon the door when opened, as shown in the central portion of Fig. 9, thereby exerting tension upon the lifting cord 53 to close the valve 47 whenever the door is opened and permitting the same to drop and to open the valve 47 when the door is closed.

Instead of employing the lever described above, to be operated by the opening of the door, a spring pressed bolt 58 may be employed, as shown in Fig. 10 which, if released by the opening of the door, will, under the tension of the spring, lift the cord 53 with the same result.

The operation of the device is as follows: When all of the doors of the elevator are closed, the valves 47 and 40 will be open and the operating valve or motor of the elevator remain under the perfect control of the conductor by the shipper mechanism. If, for instance, the elevator is ascending, the operating or main valve 6 will, by means of the shipper mechanism, have been thrown to an extreme position and such movement of the shipper mechanism by the rack and pinion connection, will have also thrown the auxiliary valve mechanism into the position shown in Fig. 4, the water from the pressure pipe 10 passing through the pipe 18 past the check valve 20, through the ports 22 and 29 of the valve 12, thence through the pipes 31 and 33 into the right end of the valve motor 28, and thence through the pipe 38 and the discharge pipe 39 to the open tank, the valve 40 being open, and the water having free course through the auxiliary valves and valve motor. If, on the other hand, the elevator be descending, the auxiliary valve and motor mechanism will, by reason of the shifting of the shipper mechanism, occupy a position at the other extreme as shown in Fig. 5. In this case, the passage of the water through the auxiliary valves is by way of the pipes 10 and 17, past the check valve 19, through the ports 21 and 24 of the valve 11, the pipe 26 and 27 to the left hand end of the valve motor 28, and thence through the pipe 37 and the discharge pipe 39 to the open tank, the valve 40 being open as before. If the elevator be brought to a standstill, the shipper mechanism being shifted to an intermediate position, the coupling between the said shipper mechanism and the racks 36 and 15 will likewise bring the valves of the auxiliary valve mechanism to an intermediate position as represented in Fig. 6, in which case, the water from the pressure pipe 10 attempting to flow through either the pipe 17 and the valve 11 or through the pipe 18 and the valve 12 is trapped between the disks 11^b and 11^c, and 12^b and 12^c occupying positions on each side of the ports 21 and 22 respectively, balancing the valves 11 and 12. It will thus be seen that so long as the valve 40 is open and there is no obstruction to the flow of water through the auxiliary valve and motor mechanism, said auxiliary mechanism is entirely idle and does not in any way affect the manipulation, by the conductor, of the main or operating valve and the motor cylinder, said operating valve being acted upon directly by the shipper mechanism and not indirectly through other valve

mechanism. If, however, during the ascent of the elevator, the auxiliary mechanism being in the position shown in Fig. 4, one of the doors of the elevator should from any cause become open, an upward pull upon the cord 53 will close the control valve 47 and through it the regulating valve 40 to obstruct the flow of water through the auxiliary valve and motor mechanism. As a result, the water in the right hand end of the valve motor 28 finding no egress through the pipes 38 and 39, exerts its pressure to the left upon the disk 35, driving said disk with its stem 34 and rack 36 to the left, the water in the left hand end of the valve motor finding egress through the pipes 27 and 25 and the port 23 to the open tank through the pipe 50. This movement continues until the rack has reached the intermediate position shown in Fig. 6, when the disk 11^a carried by the valve stem 13 will have closed the passage from the port 23 to the discharge pipe 50 and thus have equalized the pressure on both sides of the disk 35, at which time also the inlet port 22 to the valve 12 will be closed by the disks 12^b and 12^c occupying positions on both sides thereof as shown in said Fig. 6. This movement of the disk 35 with its stem 34 and rack 36 to the position shown in Fig. 6, will be positively transmitted by the coupling 44, 45 to the shipper mechanism, also closing the operating valve to the motor cylinder and stopping the elevator.

If the elevator be descending and the valve mechanism in the position shown in Fig. 5, when the elevator door is opened, the movement will be the reverse, that is, the closing of the valve 40 will cause the pressure of the water in the left hand end of the valve motor 28 to drive the disk 35 with its stem 34 and rack 36 to the right carrying with it, by means of the connection through the pinions 41 and 42, the stems 13 and 14 of the valves 11 and 12. The water in the right hand end of the valve motor 28 will escape through the pipes 33 and 32 to the right hand end of the valve 12 through the port 30 and thence to the discharge 51. This movement will continue until the disk 12^a on the valve stem 14 reaches a position to cut off the flow through the port 30 to the discharge 51, whereupon the pressure on the two sides of the piston 35 will be equalized and the inlet of water to the valve 11 will be prevented by the two disks 11^b and 11^c occupying positions on opposite sides of the port 21. At this time, again, the auxiliary mechanism will occupy the position shown in Fig. 6 and the motion will have been transmitted to the main valve and to the shipper mechanism which will then be in an inoperative position and the elevator will be stopped. In either case, the main valve and shipper mechanism are locked in this inoperative position, it being impossible to shift either because of the water trapped on both sides of the disk 35 in the valve motor 28, any interchange flow between the two ends by way of the pipes 37 and 38 being prevented by the check valves 16 therein. The shipper mechanism cannot be brought into a position to operate the elevator until the door is closed.

If it be desired to permit the elevator to proceed, but at greatly reduced speed after the closing of the valve 40 by the opening of a door, this result can be attained by so adjusting the connection between the racks 15 and the stems 13 and 14, and between the rack 36 and the stem 34, as to set the operating valve of the elevator slightly in advance or behind the auxiliary valves to effect a partial instead of a complete throttling of the motive fluid in the main valve. In order to provide for this and also to enable any lost motion to be taken up in the rack connections, the ends of the valve stems are threaded and connected with flanges 59 of the racks in the manner shown in Fig. 13. lock nuts 60 securing a fixed relation between the two.

The construction described for the closing of the valves 40 and 47 is arranged to be operated by the opening of the elevator door. Obviously, it may be automatically operated by the happening of other contingencies, or provision may be made whereby it may be manually operated.

In Figs. 11 and 12, I have shown a trip mechanism by means of which in case of accident as by the breaking of the shipper rope, the conductor will be able to stop the elevator otherwise than by opening an elevator door. In this case, the cord 53 is connected by cords 61 to spring operated bolts 62 in a manner similar to that described with reference to Fig. 9, the difference being that these bolts are not released by the opening of the door but are under all ordinary conditions held in an inoperative position by means of a detent 63 pivotally mounted and bearing against the end of the bolt 62 on the inside wall of the elevator shaft. Upon the car a spring pressed bolt 64 is held retracted by the engagement of a catch 65 in a notch cut in said bolt. If, during the ascent or descent of the elevator, the shipper rope were to break or become otherwise inoperative, the conductor may release the catch 65 from the bolt 64 which will then be projected outwardly far enough to contact with one of the detents 63 and throw it into the position shown at the lower end of Fig. 11, permitting the bolt 62, under the tension of its spring, to lift the cord 53 and close the valves 40 and 47 thus again throwing the main valve and the shipper mechanism into an inoperative position and stopping the elevator.

In Fig. 3 is shown a modified connection

between the auxiliary mechanism and the control valve, the discharge pipe 39 being tapped into a pipe 66 connecting pipes 26 and 31 and provided with check valves 67 and 68. In this case, when the auxiliary valves are idle, the flow being unobstructed by the valve 40, the water does not pass through the valve motor 28 but directly from the valves 11 and 12 through the pipe 66 past the check valves 67 or 68 as the case may be to the discharge. The operation is precisely the same as in the construction heretofore described in detail.

As a matter of convenience, I have found it desirable to use the regulating valve 40 which is closed by the closing of the valve 47, but its use may be dispensed with. If the valve 47 be placed directly in the pipe 39, the valve 40 and the pipe 46 are not needed, the lifting of the cord 53 shutting off directly, by means of the valve 47, the flow of water through the pipe 39, as indicated in Fig. 7.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a control device for elevators, the combination, with the motor, and shipper mechanism controlling the same, of means acting independently of the shipper mechanism to stop the motor and throw the shipper mechanism to its inoperative position.

2. In a control device for elevators, the combination, with the motor, and shipper mechanism controlling the same, of means acting independently of the shipper mechanism by fluid pressure to stop the motor and throw the shipper mechanism to its inoperative position.

3. In a control device for elevators, the combination, with the motor, and shipper mechanism controlling the same, of means acting independently of the shipper mechanism to stop the motor and throw the shipper mechanism to its inoperative position and lock the same.

4. In a control device for elevators, the combination, with the motor, and shipper mechanism controlling the same, of means acting automatically and independently of the shipper mechanism to stop the motor and throw the shipper mechanism to its inoperative position.

5. In a control device for elevators, the combination, with the motor, and shipper mechanism controlling the same, of means acting automatically and independently of the shipper mechanism upon the opening of the elevator door to stop the motor and throw the shipper mechanism to its inoperative position.

6. In a control device for elevators, the combination, with the motor, an operating valve, and a shipper mechanism for opening and closing the said valve, of means operating automatically and independently of the shipper mechanism upon the opening of an elevator door to close said valve.

7. In a control device for elevators, the combination, with the motor, and shipper mechanism controlling the same, of means acting independently of the shipper mechanism to stop the motor, and a connection between the said means and the shipper mechanism whereby they normally operate in unison.

8. In a control device for elevators, the combination, with the motor, and shipper mechanism controlling the same, of means acting automatically and independently of the shipper mechanism upon the opening of the elevator door to stop the motor, and a connection between the said means and the shipper mechanism whereby they normally operate in unison.

9. In a control device for elevators, the combination, with the motor, and shipper mechanism controlling the same, of an auxiliary valve and motor system, means acting automatically through the said auxiliary system, and independently of the shipper mechanism to stop the motor, and a connection between the auxiliary system and the shipper mechanism whereby they normally act in unison.

10. In a control device for elevators, the combination, with the motor, and shipper mechanism controlling the same, of an auxiliary valve and motor system, means acting automatically through the said auxiliary system and independently of the shipper mechanism upon the opening of the elevator door to stop the motor, and a connection between the auxiliary system and the shipper mechanism whereby they normally act in unison.

11. In a control device for elevators, the combination, with the motor, and shipper mechanism controlling the same, of an auxiliary valve and motor system acting upon the motor independently of the shipper mechanism, and means acting automatically through the said auxiliary system to stop the motor and throw the shipper mechanism to its inoperative position.

12. In a control device for elevators, the combination, with the motor, and shipper mechanism controlling the same, of an auxiliary valve and motor system acting upon the motor independently of the shipper mechanism, and means acting automatically through the said auxiliary system upon the opening of an elevator door to stop the motor and throw the shipper mechanism to its inoperative position and lock the same.

13. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism, a pressure fluid supply

to the auxiliary system, a control valve governing the discharge therefrom, and means to actuate the control valve to cause the operation by pressure fluid of the auxiliary system and through it the shifting of the shipper mechanism to an inoperative position.

14. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism, a pressure fluid supply to the auxiliary system, a control valve governing the discharge therefrom, and means actuated by the opening of the elevator door to close the control valve to cause the operation by pressure fluid of the auxiliary system and through it the shifting of the shipper mechanism to an inoperative position.

15. In a control device for elevators, the combination with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system positively coupled with the shipper mechanism, a pressure fluid supply to the auxiliary system, a control valve governing the discharge therefrom, and means actuated by the opening of the elevator door to close the control valve to cause the operation by the pressure fluid of the auxiliary system and through it the shifting of the shipper mechanism to an inoperative position.

16. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system positively coupled with the shipper mechanism, a pressure fluid supply to the auxiliary system, a regulating valve in the discharge therefrom a control valve governing the operation of the regulating valve, and means operating automatically to actuate the control valve to close the regulating valve to cause the operation by the pressure fluid of the auxiliary system and through it the shifting of the shipper mechanism to an inoperative position.

17. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism, a pressure fluid supply to the auxiliary system, a regulating valve operable by variations in fluid pressure arranged in the discharge therefrom, an auxiliary pressure fluid pipe around the auxiliary system by way of the regulating valve to a point adjacent the elevator shaft, a control valve in the auxiliary pressure pipe, and means operating automatically upon the opening of the elevator door to close the control valve to operate the regulating valve to cause the operation by the pressure fluid of the auxiliary system and through it the shifting of the shipper mechanism to an inoperative position.

18. In a control device for elevators, the combination with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system positively coupled with the shipper mechanism, a pressure fluid supply to the auxiliary system, a regulating valve operable by variations in fluid pressure arranged in the discharge from the auxiliary system, an auxiliary pressure fluid pipe extending by way of the regulating valve to a point adjacent the elevator shaft, a control valve in the auxiliary pressure pipe, and means connecting the control valve stem with the elevator door whereby the opening of the elevator door will operate the control valve to close the regulating valve to cause the operation by the pressure fluid of the auxiliary system and through it the shifting of the shipper mechanism to an inoperative locked position.

19. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism and comprising a pair of twin valves having their stems provided with spaced disks controlling inlet and outlet ports and a valve motor having its stem provided with a disk, a control valve arranged to govern the discharge from the auxiliary system, a pressure fluid supply at one position of the shipper mechanism and valves through one of the twin valves and one end of the valve motor to the discharge and at another position thereof through the other twin valve to the other end of the valve motor and to the discharge, and means operating automatically to close the control valve to cause the pressure fluid within the auxiliary system to act upon the disks and shift the same and the coupled shipper mechanism to an inoperative position.

20. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor mechanism coupled with the shipper mechanism and comprising a pair of twin valves having their stems rigidly coupled and provided with spaced disks controlling inlet and outlet ports and a valve motor having its stem provided with a disk and coupled with the stems of the twin valves, a control valve arranged to govern the discharge from the auxiliary system, a pressure fluid supply at one position of the shipper mechanism and valves through one of the twin valves and one end of the valve motor to the discharge and at another position thereof through the other twin valve and the other end of the valve motor to the discharge, check valves in the supply to each of the twin valves and between each end of

the valve motor and discharge, and means operating automatically upon the opening of an elevator door to actuate the control valve to cause pressure fluid within the auxiliary system to act upon the disks to shift the same and the coupled shipper mechanism to an intermediate position and there lock the same.

21. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system comprising a pair of twin valves having their stems rigidly coupled by a rack and provided with spaced disks controlling inlet and outlet ports and a valve motor having its stem provided with a disk and a rack, a spindle coupled to the shipper mechanism and carrying pinions in engagement with the racks, a control valve in the discharge from the auxiliary system, a pressure fluid supply at one position of the valves through one of the twin valves and one end of the valve motor to the discharge and at another position thereof through the other twin valve and the other end of the valve motor to the discharge, check valves in the supply to each of the twin valves and between each end of the valve motor and the discharge, and means operating automatically upon the opening of the elevator door to actuate the control valve to cause the pressure fluid within the auxiliary system to act upon the disks to shift the same and the coupled shipper mechanism to an intermediate position.

22. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism and comprising a pair of twin valves having their stems rigidly coupled and provided with spaced disks controlling inlet and outlet ports and a valve motor having its stem provided with a disk and coupled with the stems of the twin valves, a regulating valve operable by variations in fluid pressure arranged in the discharge from the auxiliary system, a pressure fluid supply at one position of the auxiliary valves through one of the twin valves and one end of the valve motor to the discharge and at another position thereof to the other twin valve to the other end of the valve motor to the discharge, an auxiliary pressure pipe extending by way of the regulating valve to a point adjacent the elevator shaft, a control valve in the auxiliary pressure pipe, and means operating automatically upon the opening of the elevator door to actuate the control valve to close the regulating valve to cause the pressure fluid within the auxiliary system to act upon the disks to shift the same and the coupled shipper mechanism to an intermediate position.

23. In a control device for elevators, the combination with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system comprising a pair of twin valves having their stems rigidly coupled by a rack and provided with spaced disks controlling inlet and outlet ports and a valve motor having its stem provided with a disk and with a rack, a spindle coupled to the shipper mechanism and carrying pinions in engagement with the racks, a regulating valve operable by variations in fluid pressure arranged in the discharge from the auxiliary system, a pressure fluid supply at one position of the valves through one of the twin valves and one end of the valve motor to the discharge and at another position thereof through the other twin valve and the other end of the valve motor to the discharge, check valves in the supply to each of the twin valves and between each end of the valve motor and discharge, an auxiliary pressure pipe extending by way of the regulating valve to a point adjacent the elevator shaft, a control valve in the auxiliary pressure pipe beyond the regulating valve, and means operating automatically upon the opening of the elevator door to actuate the control valve to close the regulating valve and cause the pressure fluid within the auxiliary system to act upon the disks to shift the same and the coupled shipper mechanism to an intermediate locked position.

24. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of means to control and actuate the valve acting independently of shipper mechanism, and means operative through said actuating means when the elevator door is open to throw the operating valve and shipper mechanism automatically to an inoperative position.

25. In a control device for elevators, the combination, with an operating valve, shipper mechanism acting thereon, and means to close said valve acting independently of the shipper mechanism, of a member movably mounted adjacent the elevator door, and a connection between said member and the valve closing means whereby the opening of the elevator door will operate to automatically stop the elevator.

26. In a control device for elevators, the combination, with an operating valve, shipper mechanism acting thereon, and means to control and actuate the shipper mechanism of a lever pivoted adjacent the elevator door and arranged to be operated by the opening of the door, and a mechanical connection between the lever and means controlling and actuating the shipper mechanism whereby the opening of the door will operate to shift the shipper mechanism to an inoperative position.

27. In a control device for elevators, the

combination, with an operating valve, shipper mechanism acting thereon, and means to control and actuate the shipper mechanism of a lever pivoted adjacent the elevator door and provided with an anti-friction roll arranged to ride upon the door when opened, and a mechanical connection between the lever and means controlling and actuating the shipper mechanism whereby the opening of the door will operate to shift the shipper mechanism to an inoperative locked position.

28. In a control device for elevators, the combination, with an operating valve, shipper mechanism acting thereon, and means to control and actuate the shipper mechanism of means tending to act upon the controlling and actuating means to shift the shipper mechanism to an inoperative position, a detent holding said shifting means out of action, and a trip under the control of the elevator conductor for displacing the detent to permit the shifting of the shipper mechanism.

29. In a control device for elevators, the combination, with an operating valve, shipper mechanism acting thereon, and means to control and actuate the shipper mechanism of a spring pressed bolt connected with said controlling and actuating means and tending to act upon the same to shift the shipper mechanism to an inoperative position, a detent holding said bolt out of action, and a trip under the control of the elevator conductor for displacing the detent to release the bolt to permit the shifting of the shipper mechanism.

30. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of means operating automatically to throw said shipper mechanism from an operative into an inoperative position, and means under the control of the conductor and other than the shipper mechanism for shifting the shipper mechanism into an inoperative position.

31. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism, and distinct means one under the control of the elevator conductor and the other acting automatically through the auxiliary system to throw the shipper mechanism into an inoperative position.

32. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism, and distinct means one under the control of the elevator conductor and the other beyond his control and acting automatically upon the opening of an elevator door to throw the shipper mechanism into an inoperative locked position.

33. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism, a lever pivoted adjacent the elevator door beyond the control of the elevator conductor and arranged to be actuated by the opening of the door, a spring pressed bolt, a detent holding said bolt out of action, a trip under the control of the elevator conductor for displacing the detent to release the bolt, and means connecting the lever and bolt with the auxiliary system whereby the shifting of the lever or the releasing of the bolt will act through the auxiliary system to throw the shipper mechanism into an inoperative locked position.

34. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism, a lever pivoted adjacent the elevator door and arranged to be actuated by the opening of the door, and a mechanical connection between the lever and auxiliary system whereby the opening of the door will shift the shipper mechanism to an inoperative position.

35. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism, a pressure fluid supply to the auxiliary system, a control valve governing the discharge therefrom, a lever pivoted adjacent the elevator door and arranged to ride upon the door when opened, and a connection between the lever and control valve whereby the opening of the door will through the auxiliary system shift the shipper mechanism to an inoperative position.

36. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system positively coupled with the shipper mechanism, a pressure fluid supply to the auxiliary system, a regulating valve in the discharge therefrom, a control valve governing the operation of the regulating valve, a lever pivoted adjacent the elevator door and arranged to ride upon the door when opened, and a connection between the lever and control valve whereby the opening of the door will through the auxiliary system shift the shipper mechanism to an inoperative position.

37. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism and comprising a pair of twin valves having their stems provided with spaced disks controlling inlet and outlet ports and a valve motor having its stem provided with a disk, a control valve

arranged to govern the discharge from the auxiliary system, a pressure fluid supply at one position of the shipper mechanism and valves through one of the twin valves and one end of the valve motor to the discharge and at another position thereof through the other twin valve and the other end of the valve motor to the discharge, a lever pivoted adjacent the door and arranged to ride upon the door when opened, and a connection between the lever and control valve whereby the opening of the door will operate the auxiliary system and shift the shipper mechanism to an inoperative position.

38. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor mechanism coupled with the shipper mechanism and comprising a pair of twin valves having their stems rigidly coupled by a rack and provided with spaced disks controlling inlet and outlet ports and a valve motor having its stem provided with a disk and a rack, a spindle coupled to the shipper mechanism and carrying pinions in engagement with the racks, a control valve in the discharge from the auxiliary system, a pressure fluid supply at one position of the valves through one of the twin valves and one end of the valve motor to the discharge and at another position thereof through the other twin valve and the other end of the valve motor to the discharge, check valves in the supply to each of the twin valves and between the two ends of the valve motor, a lever pivoted adjacent the elevator door and arranged to ride upon the door when opened, and a connection between the lever and control valve whereby the opening of the door will operate the auxiliary system to shift the shipper mechanism to an inoperative locked position.

39. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system comprising a pair of twin valves having their stems rigidly coupled by a rack and provided with spaced disks controlling inlet and outlet ports and a valve motor having a stem provided with a disk and with a rack, a spindle coupled to the shipper mechanism and carrying pinions in engagement with the racks, a regulating valve operable by variations in fluid pressure arranged in the discharge from the auxiliary system, a pressure fluid supply at one position of the valves through one end of the twin valves and one end of the valve motor to the discharge and at another position thereof through the other twin valve and the other end of the valve motor to the discharge, check valves in the supply to each of the twin valves and between the two ends of the valve motor, an auxiliary pressure pipe extending by way of the regulating valve to a point adjacent the elevator shaft, a control valve in the auxiliary pressure pipe beyond the regulating valve, a lever pivoted adjacent the elevator door and arranged to ride upon the door when opened, and a connection between the lever and the stem of the control valve whereby the opening of the elevator door will through the auxiliary system shift the shipper mechanism to an inoperative locked position.

40. In a control device for elevators, the combination with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism and comprising a pair of twin valves having their stems provided with spaced disks controlling inlet and outlet ports and a valve motor having its stem provided with a disk, a pressure fluid supply at one position of the shipper mechanism and valves through one of the twin valves to the discharge and at another position thereof through the other twin valve to the discharge, a control valve arranged to govern the discharge from the auxiliary system, a connection between each of the twin valves and each end of the valve motor, and means operating automatically upon the opening of the elevator door to close the control valve to cause the pressure fluid within the auxiliary system to act upon the disk of the valve motor and shift the same and the coupled shipper mechanism to an inoperative position.

41. In a control device for elevators, the combination, with an operating valve and shipper mechanism acting thereon, of an auxiliary valve and motor system coupled with the shipper mechanism, a pressure fluid supply to the auxiliary system, a control valve arranged directly in the discharge from the auxiliary system, and a connection between the stem of the control valve and the elevator door whereby the opening of the door will actuate the control valve to cause the operation by the pressure fluid of the auxiliary system and through it the shifting of the shipper mechanism to an inoperative position.

In testimony whereof I affix my signature to this specification, in the presence of two witnesses.

SAMUEL S. TEAGUE.

Witnesses:
L. T. GREIST,
EDWIN O. HILDEBRAND.

No. 852,358. PATENTED APR. 30, 1907.

S. S. TEAGUE.

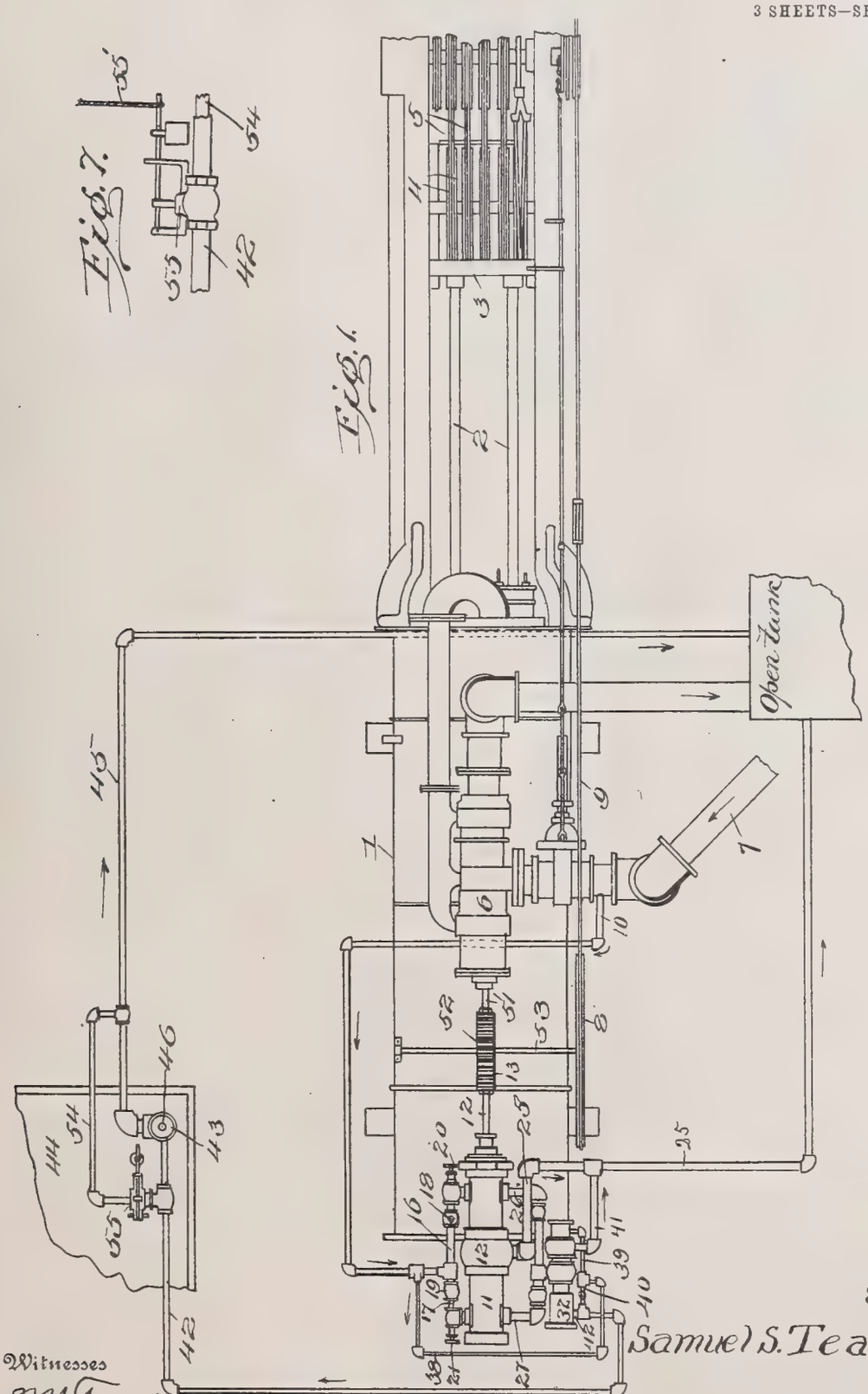
AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

APPLICATION FILED JUNE 7, 1906.

3 SHEETS—SHEET 1.

Fig. 7.

Fig. 1.



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No. 852,358. PATENTED APR. 30, 1907.

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AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

APPLICATION FILED JUNE 7, 1906.

3 SHEETS—SHEET 2.

Fig. 2.

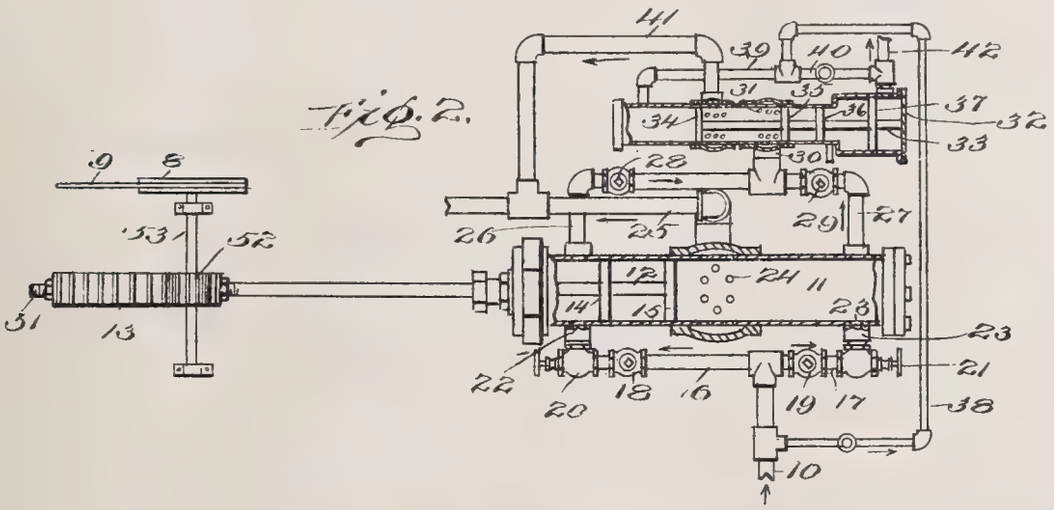


Fig. 3.

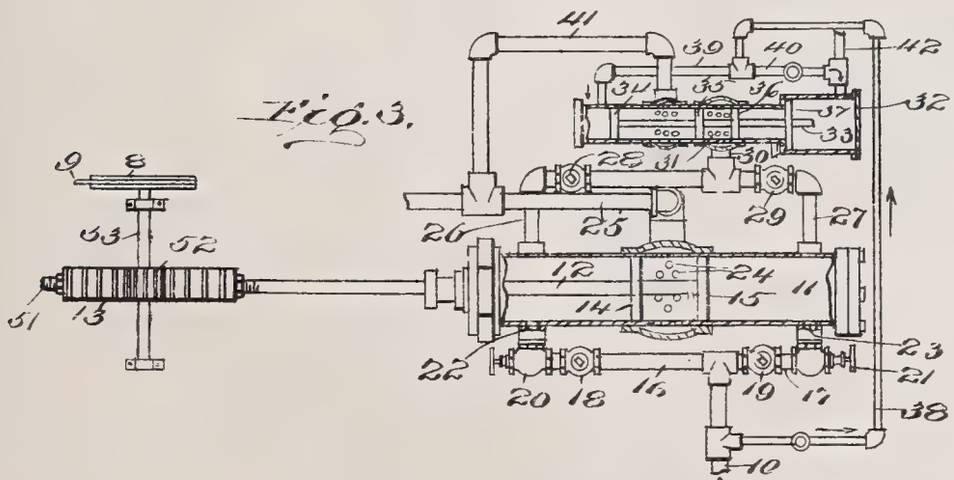
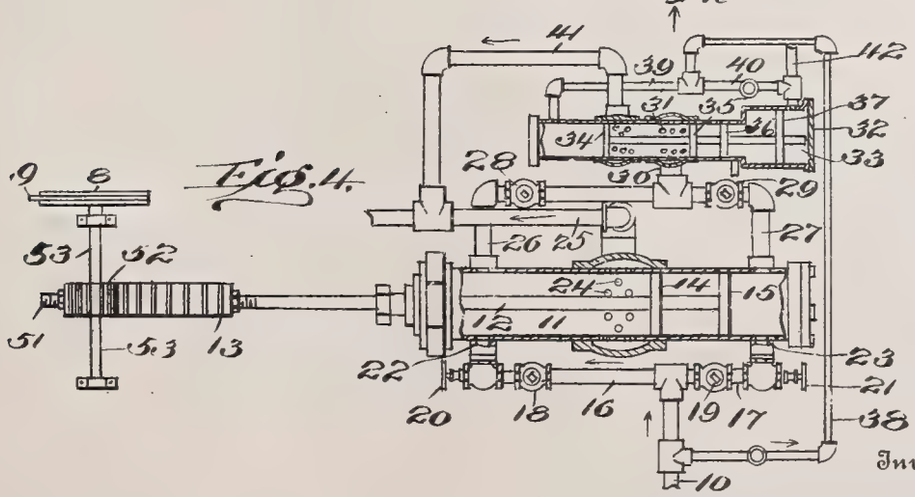


Fig. 4.



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No. 852,358. PATENTED APR. 30, 1907.

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AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

APPLICATION FILED JUNE 7, 1906.

3 SHEETS—SHEET 3

Fig. 5.

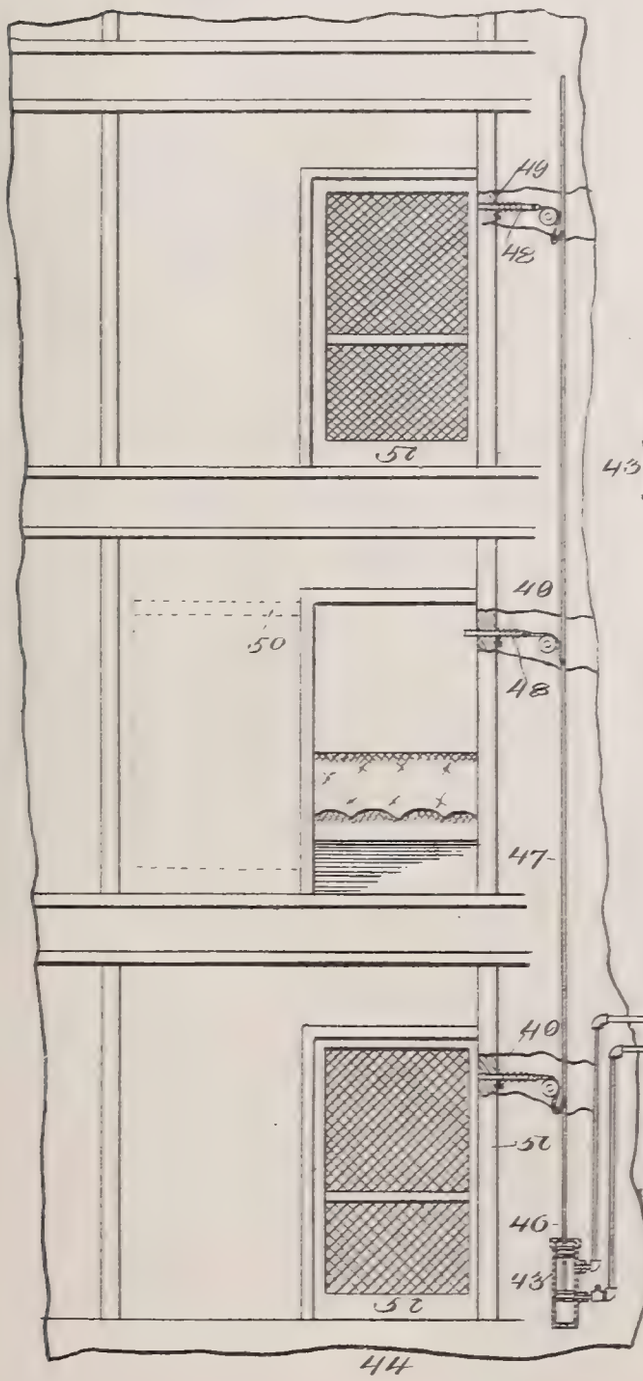
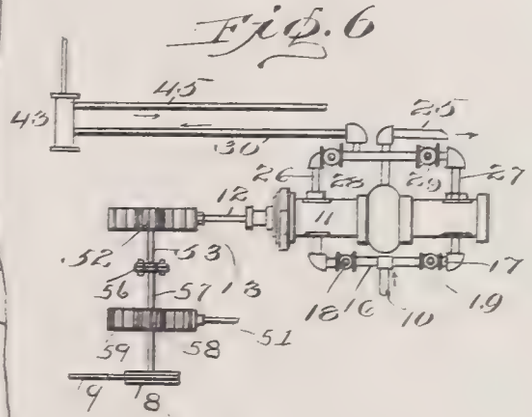
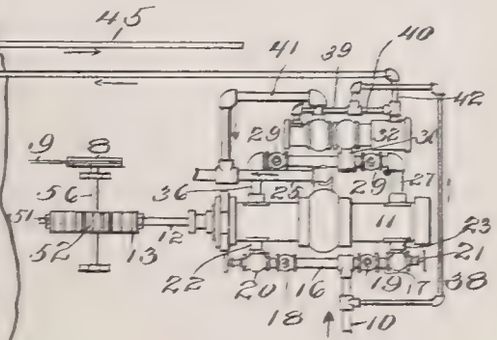


Fig. 6





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UNITED STATES PATENT OFFICE.

SAMUEL S. TEAGUE, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR OF FIFTY-ONE ONE-HUNDREDTHS TO JOSEPH I. SAKS.

AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

No. 852,358. Specification of Letters Patent. Patented April 30, 1907.

Application filed June 7, 1906. Serial No. 320,509.

To all whom it may concern:

Be it known that I, SAMUEL S. TEAGUE, engineer, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Automatic Control Devices for Elevators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to automatic control devices for elevators and has for its object means by which the operation of the elevator is automatically controlled by the opening and closing of the elevator door. In devices of this general character, it is old to provide means whereby the elevator having been stopped at a particular landing and the door opened, a start cannot again be made until the door is closed; also to provide means such as counterweights or springs whereby when the operating lever is released, it will return to its inoperative position; also to provide for the shutting off of the water supply to the operating cylinder upon the opening of the elevator door or similar contingency.

As distinguished from these, my invention provides that upon the opening of the elevator door, for instance, means are set in motion whereby through hydraulic pressure, the shipper mechanism is itself thrown to an inoperative position and there locked. Provision is also made, whereby, after the shipper mechanism is rendered inoperative by the opening of a door, it may be released by the conductor to enable the car to be moved slowly to the point where the door is open for the purpose of closing the same.

The invention consists, moreover, in certain features of construction whereby the different elements co-operate to secure the desired result in a perfectly automatic and entirely certain and efficient manner.

The invention, as hereinafter more fully described and as particularly set out in the claims, will be readily understood from an inspection of the accompanying drawings setting forth a preferred embodiment of the same and modifications.

In these drawings Figure 1 is a general view of the device assembled in connection with the operating cylinder of an elevator; Fig. 2 is a horizontal section through the device in one position of operation; Fig. 3 is a similar view to Fig. 2 at an intermediate locked position; Fig. 4 is a similar view to Fig. 2 in the other extreme position of operation; Fig. 5 is a view showing an operative connection between the device and the elevator doors; Fig. 6 is a top plan of a modification; and Fig. 7 is a fragmentary view in elevation of a valve employed.

While the invention may be readily applied to any ordinary form of elevator, I have illustrated and will describe the same as connected with a hydraulic elevator.

The main operating cylinder 1, containing the usual pistons operating by and through the piston rods 2 and the cross head 3 upon the sheaves 4 to communicate motion by means of the ropes 5 to the elevator car in a well known manner, is supplied with water through the operating valve 6 of ordinary construction from a pressure tank (not shown) by means of a pipe 7. This operating valve is manipulated in the well known way from a pulley 8 operated from the car by the shipper rope 9. The manipulation of this operating valve might be effected by means of levers, rods or any other well known structure, the term "shipper mechanism" being used hereinafter to embrace any device for manipulating the operating means from the car.

A fluid pressure pipe 10, tapping the supply from the pressure tank, leads to a valve mechanism forming the important part of my invention and composed, principally, of the auxiliary valve 11, the stem 12 of which is adjustably connected at its extremity with the rack 13 and is provided with disks 14 and 15. The connection between the pressure pipe 10 and the auxiliary valve 11 is by means of branch pipes 16 and 17, provided with check valves 18 and 19 permitting of a flow in a forward direction only, and also with manually operable valves 20 and 21, the branch pipes 16 and 17 communicating with the respective ends of the auxiliary valve 11 by ports 22 and 23. The port 24 opens from the central portion of the valve 11 to the discharge pipe 25 leading to an open tank.

Pipes 26 and 27, containing check valves 28 and 29, lead from the two ends of the valve 11 to the pipe 30, communicating with the port 31 arranged intermediate the two extremes of a differential valve 32, provided

with a piston 33, carrying disks 34, 35, 36 and 37, the latter of which is of greater diameter. A small pipe 38 leads from the pressure pipe 10 and communicates by two branches 39 and 40 with the two ends of the differential valve 32. A discharge pipe 41 leads from the intermediate portion of the valve 32 to the open tank by way of the discharge 25, and a waste pipe 42 leads from the larger end of the valve 32 to a control valve 43, located adjacent to the lower portion of the elevator shaft 44, from whence a waste pipe 45 leads to the open tank. The control valve 43, shown in section in Fig. 5, is a simple balanced valve having an inlet from pipe 42 and an outlet to pipe 45 with spaced disks so arranged that in the upper position the lower disk closes the inlet and in the lower position the inlet and outlet communicate by means of the space between the disks. The stem and disks of this valve are raised to close the same in the manner hereinafter described, and return to the normal open position of their own weight.

Attached to the stem 46 of the control valve 43 is a cord or rope 47 extending upward through the elevator shaft. Spring pressed bolts 48, attached to the cord 47, are held retracted against the tension of the springs 49 by the closed elevator doors 50 (as shown in the upper and lower portions of Fig. 5). These bolts when released by the opening of the door, (as indicated in the central portion of Fig. 5) will, under the tension of their springs, exert a pull upon the lifting cord 47 to close the valve 43, and again permit the same to drop and to open the valve 43 when the door is closed.

The rack 13 carried by the stem 12 of the valve 11 is also connected with the stem 51 of the main operating valve 6, forming a rigid coupling between the stems of the auxiliary valve 11 and the operating valve 6. This rack 13 is in engagement with a pinion 52 keyed to a spindle 53, upon which is mounted the pulley 8 of the shipper mechanism, wherefore it will be seen that any movement of the auxiliary valve will be positively transmitted to the shipper mechanism and the operating valve.

The operation of the device is as follows: When all of the doors of the elevator are closed, the control valve 43 will be opened and the operating valve of the elevator will remain under the perfect control of the conductor by the shipper mechanism. If, for instance, the elevator is ascending, the operating valve 6 will, by means of the shipper mechanism, have been thrown to an extreme position and such movement of the shipper mechanism and operating valve will have also, by the rack connection, thrown the auxiliary valve into the position shown in Fig. 2, the water from the pressure pipe 10 passing through the pipe 17, past the check valve 19 and through the port 23 into the right hand end of the valve 11, and thence through the port 24 and the discharge 25 to the open tank, a portion also passing through the pipe 27 by way of the central portion of the differential valve 32 and the pipe 41 to the open tank, the water thus having free and uninterrupted course through the valve system. If, on the other hand, the elevator be descending, the auxiliary valve 11 will, by reason of the shifting of the shipper mechanism and the operating valve, occupy a position at the other extreme as shown in Fig. 4. In this case, the course of the water through the valve system is by way of the pipes 10 and 16, past the check valve 18, through the port 22 to the left hand end of the valve 11, and thence through the port 24 and the discharge pipe 25 to the discharge, there also being a flow from the left hand end of the valve 11 through the pipe 26, past the check valve 28 and through the central portion of the differential valve 32 by way of the discharge pipe 41 to the open tank. If the elevator be brought to a standstill, the shipper mechanism being shifted to an intermediate position, the rack coupling between the shipper mechanism and the two valves 6 and 11 will likewise bring the auxiliary valve 11 to an intermediate position as represented in Fig. 3, in which case the water from the pressure pipe 10, attempting to flow through either the pipe 16 and the left hand end of the valve 11, or through the pipe 17, and the right hand end of the valve 11, finds no egress through the port 24 to the discharge 25, by reason of the disks 14 and 15 occupying positions one on either side of said port 24, whereby the said valve 11 is balanced.

In either of the three positions referred to, the elevator doors all being closed and as a result the valve 43 being open, the differential valve 32 remains in the position shown in Figs. 2 and 4, the waste pipe 42 relieving the pressure from the larger disk 37 so that the piston of said valve is held by the pressure of the water entering the left hand end of said valve from the pipe 39 in its extreme position as shown. It will be seen that under these conditions the water entering the right and left hand ends of valve 11 and finding no egress through the port 24 and pipe 25, may pass through both the pipes 26 and 27 through the differential valve 32 and the pipe 41 to the open tank. Thus, so long as the valve 43 is open and there is no obstruction to the waste of water from the larger end of the differential valve, said valve remains in the position shown in Figs. 2 and 4 and the auxiliary valve 11 is entirely idle and does not in any way affect the manipulation, by the conductor, of the operating valve and the main cylinder. If, however, during the ascent of the elevator, the valve mechanism being in the position shown in Fig. 2, one of

the doors of the elevator should from any cause become opened, an upward pull upon the cord 47 will close the control valve 43 and the excess pressure upon the right hand end of the piston of the differential valve, due to the larger area of the disk 37, will throw said piston to the left into the position shown in Fig. 3, whereby the passage of water from either end of the auxiliary valve 11 through said differential valve is prevented by reason of the disks 35 and 36 occupying positions on either side of the port 31′. As a result, the water entering the left hand end of the valve 11 and finding no egress through the pipe 26, exerts its pressure to the right upon the disk 14, driving said disk with its stem 12 to the right, the water in the right hand end of the valve 11 finding egress through the port 24 and pipe 25 to the open tank. This movement continues until the rack 13 has reached the intermediate position shown in Fig. 3, when the disk 15 carried by the valve stem 12 will have closed the passage from the right hand end of the valve 11 to the port 24 and thus have equalized the pressure on both disks 14 and 15, which disks will occupy positions on either side of the port 24, as shown in Fig. 3. This movement of the stem 12 of the auxiliary valve 11 is transmitted by the rack coupling to the operating valve 6 and also to the shipper mechanism, whereby both are thrown to an inoperative position and the elevator is stopped If the elevator be descending and the valve mechanism in the position shown in Fig. 4, when the elevator door is opened the movement will be the reverse, that is, the closing of the passage through the differential valve 32 will cause the pressure of the water in the right hand end of the valve 11 to drive the disk 15 with its stem 12 and the rack 13 to the left. The water in the left hand end of the valve 11 will escape through the port 24 and the pipe 25 until the combined movement of the rack and valve stem to the left brings the disk 14 to a position to cut off the flow through the port 24 and the discharge pipe 25, whereupon, the pressure on the two disks 14 and 15 will be equalized, said disks occupying again the positions shown in Fig. 3 on each side of the port 24. In this case also the motion will have been transmitted by the rack to the operating valve and shipper mechanism, both of which will then be in an intermediate inoperative position and the elevator will be stopped. In either case, the shipper mechanism and operating valve is locked in its inoperative position, it being impossible to shift the same because of the water trapped in both ends of the valve 11, any interchange of flow between the two ends being prevented by the check valves. It will be seen, therefore, that the shipper mechanism and operating valve can not be brought into a position to operate the elevator until the door is closed, or by some other means the flow of the waste from the larger end of the differential valve 32 through the pipe 42 is resumed.

It might happen that through some interference or accident an elevator door on the top floor of a tall building should become opened when the elevator was at the bottom of the shaft. In such a case it becomes important that means be provided whereby, the elevator having been once stopped and the conductor placed upon his guard, he should be enabled to move the elevator carefully and guardedly up to the open door to close the same. To accomplish this result, I may provide a bypass 54 around the control valve 43, said by-pass being normally closed by a weighted safety valve 55 of ordinary construction, a cord 55′ leading from said valve to a position in the elevator car so that if the elevator is locked in an inoperative position by the opening of the door the conductor may, by the operation of this cord, open the safety valve and establish a flow through the by-pass 54, whereupon the piston of the differential valve would move from the position shown in Fig. 3 to that shown in Fig. 2, restoring control over the shipper mechanism and operating valve to the conductor.

In Fig. 6 I have shown a modified connection between the auxiliary valve 11 and the control valve 43, by which the differential valve 32 is entirely dispensed with, the pipe 30 instead of leading from the valve 11 to the differential valve 32 proceeding directly to the control valve 43. It will be seen that the operation of the valve 43 directly controls the flow of water from both ends of the valve 11. By this arrangement the construction is much simplified and would in many cases be preferable to that shown in the other views and previously described. In connection with Fig. 6 also is shown a further modified connection between the auxiliary valve and the control valve, the rack 13 being in this case not connected directly with the stem 51 of the operating valve but indirectly, the spindle 53 of the pinion 52 being coupled at 56 to another spindle 57 carrying a pinion 58 engaging with a second rack 59 connected with the stem 51 of the operating valve 6. In this case the pulley 8 of the shipper mechanism could be mounted upon either the spindle 53 or 57.

The invention, as herein set forth, being an improvement in or modification of that disclosed in my copending application, Serial No. 317,226, is not claimed broadly here, but in such companion application to which reference is hereby made.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:—

1. In a control device for elevators, the combination, with elevator operating means, and shipper mechanism acting thereon, of a

valve having its stem coupled with the shipper mechanism and provided with a disk, a pressure fluid supply to both ends of the valve, discharge ports from both ends of the valve and from an intermediate point, the intermediate discharge port controlled by the valve disk, and means operating automatically to interrupt the flow through the end discharge ports.

2. In a control device for elevators, the combination, with elevator operating means, and shipper mechanism acting thereon, of a valve having its stem coupled with the shipper mechanism and provided with a disk, a pressure fluid supply to both ends of the valve, discharge ports from both ends of the valve and from an intermediate point, the intermediate discharge port controlled by the valve disk, and means operating automatically upon the opening of an elevator door to interrupt the flow through the end discharge ports.

3. In a control device for elevators, the combination, with elevator operating means, and shipper mechanism acting thereon, of a valve having its stem coupled with the shipper mechanism and provided with a disk, a pressure fluid supply to both ends of the valve, discharge ports from both ends of the valve and from an intermediate point, the intermediate discharge port controlled by the valve disk, check valves arranged in the pressure fluid supply and in the discharge from the end ports, and means operating automatically to interrupt the flow through the end discharge ports.

4. In a control device for elevators, the combination, with elevator operating means, and shipper mechanism acting thereon, of an auxiliary valve having its stem coupled with the shipper mechanism and provided with a disk, a pressure fluid supply leading by branch pipes containing check valves to both ends of the auxiliary valve, a discharge port from the auxiliary valve intermediate its two ends and arranged to be controlled by the disk, discharge pipes containing check valves and leading from both ends of the auxiliary valve to a common pipe, and a control valve operating automatically upon the opening of an elevator door to interrupt the flow through the last named discharge pipes.

5. In a control device for elevators, the combination, with elevator operating means, and shipper mechanism acting thereon, of an auxiliary valve having its stem coupled with the shipper mechanism and provided with spaced disks, a pressure fluid supply to both ends of the valve, a discharge from both ends of the valve and from an intermediate point, the intermediate point of discharge occupying a position between the spaced disks when the shipper mechanism is in an inoperative position, and means operating automatically upon the opening of an elevator door to interrupt the discharge from the two ends of the auxiliary valve.

6. In a control device for elevators, the combination, with elevator operating means, and shipper mechanism acting thereon, of an auxiliary valve having its stem coupled with the shipper mechanism and provided with a disk, a pressure fluid supply by branch pipes containing check valves to both ends of the auxiliary valve, a discharge port arranged intermediate the two ends of the auxiliary valve and controlled by the disk, discharge pipes containing check valves leading from the two ends of the auxiliary valve to a common pipe, a differential piston valve provided with inlet and outlet ports for the passage of the discharge from the two ends of the auxiliary valve, said ports controlled by disks carried by the piston of said valve, a pressure fluid supply to the larger and smaller ends of the differential valve, a waste pipe leading from the larger end of the differential valve, a control valve arranged in the waste pipe, and means operating automatically upon the opening of an elevator door to close the control valve to interrupt the waste from the differential valve.

7. In a control device for elevators, the combination, with elevator operating means, and shipper mechanism acting thereon, of an auxiliary valve having its stem coupled with the shipper mechanism and provided with a disk, a pressure fluid supply by branch pipes containing check valves to both ends of the auxiliary valve, a discharge port arranged intermediate the two ends of the auxiliary valve and controlled by the disk, discharge pipes containing check valves leading from the two ends of the auxiliary valve to a common pipe, a differential piston valve provided with inlet and outlet ports for the passage of the discharge from the two ends of the auxiliary valve, said ports controlled by disks carried by the piston of said valve, a pressure fluid supply to the larger and smaller ends of the differential valve, a waste pipe leading from the larger end of the differential valve, a control valve arranged in the waste pipe, a spring pressed bolt normally held retracted against the tension of its spring by the closed elevator door, and a connection between the bolt and the control valve whereby the opening of the door will close the control valve.

8. In a control device for elevators, the combination, with elevator operating means, and shipper mechanism acting thereon, of means operating automatically upon the opening of an elevator door to throw said shipper mechanism from an operative into an inoperative locked position, and means under the control of the conductor and other than the shipper mechanism for releasing the said shipper mechanism.

9. A control device for elevators, the com-

bination, with elevator operating means and shipper mechanism acting thereon, of an auxiliary valve system coupled with the shipper mechanism, means operating automatically upon the opening of an elevator door through the auxiliary valve system to throw said shipper mechanism from an operative into an inoperative locked position, and means under the control of the conductor and other than the shipper mechanism for releasing the shipper mechanism from its locked position.

10. In a control device for elevators, the combination, with elevator operating means, and shipper mechanism acting thereon, of an auxiliary valve having its stem coupled with the shipper mechanism and provided with a disk, a pressure fluid supply by branch pipes containing check valves to both ends of the auxiliary valve, a discharge port arranged intermediate the two ends of the auxiliary valve and controlled by the disk, discharge pipes containing check valves leading from the two ends of the auxiliary valve to a common pipe, a differential piston valve provided with inlet and outlet ports for the passage of the discharge from the two ends of the auxiliary valve, said ports controlled by disks carried by the piston of said valve, a pressure fluid supply to the larger and smaller ends of the differential valve, a waste pipe leading from the larger end of the differential valve, a control valve arranged in the waste pipe, means operating automatically upon the opening of an elevator door to close the control valve to interrupt the waste from the differential valve, and means for reëstablishing the waste independent of the control valve.

11. In a control device for elevators, the combination, with elevator operating means, and shipper mechanism acting thereon, of an auxiliary valve having its stem coupled with the shipper mechanism and provided with a disk, a pressure fluid supply by branch pipes containing check valves to both ends of the auxiliary valve, a discharge port arranged intermediate the two ends of the auxiliary valve and controlled by the disk, discharge pipes containing check valves leading from the two ends of the auxiliary valve to a common pipe, a differential piston valve provided with inlet and outlet ports for the passage of the discharge from the two ends of the auxiliary valve, said ports controlled by disks carried by the piston of said valve, a pressure fluid supply to the larger and smaller ends of the differential valve, a waste pipe leading from the larger end of the differential valve, a control valve arranged in the waste pipe, means operating automatically upon the opening of an elevator door to close the control valve to interrupt the waste from the differential valve, a by-pass arranged in the waste around the control valve, a valve controlling said by-pass, and means within the control of the conductor for operating the said last named valve.

12. In a control device for elevators, the combination, with elevator operating means, and shipper mechanism acting thereon, of an auxiliary valve having its stem coupled with the shipper mechanism and provided with a disk, a pressure fluid supply by branch pipes containing check valves to both ends of the auxiliary valve, a discharge port arranged intermediate the two ends of the auxiliary valve and controlled by the disk, discharge pipes containing check valves leading from the two ends of the auxiliary valve to a common pipe, a differential piston valve provided with inlet and outlet ports for the passage of the discharge from the two ends of the auxiliary valve, said ports controlled by disks carried by the piston of said valve, a pressure fluid supply to the larger and smaller ends of the differential valve, a waste pipe leading from the larger end of the differential valve, a control valve arranged in the waste pipe, means operating automatically upon the opening of an elevator door to close the control valve to interrupt the waste from the differential valve, a by-pass in the waste around the control valve, a safety valve arranged in the by-pass and normally held closed, and means within the control of the conductor for opening the safety valve.

In testimony whereof I affix my signature to this specification, in the presence of two witnesses.

SAMUEL S. TEAGUE.

Witnesses:
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EDWIN O. HILDEBRAND.

No. 897,566. PATENTED SEPT. 1, 1908.

F. W. A. WIESEBROCK.

SAFETY DEVICE FOR CONVEYANCES.

APPLICATION FILED JUNE 17, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

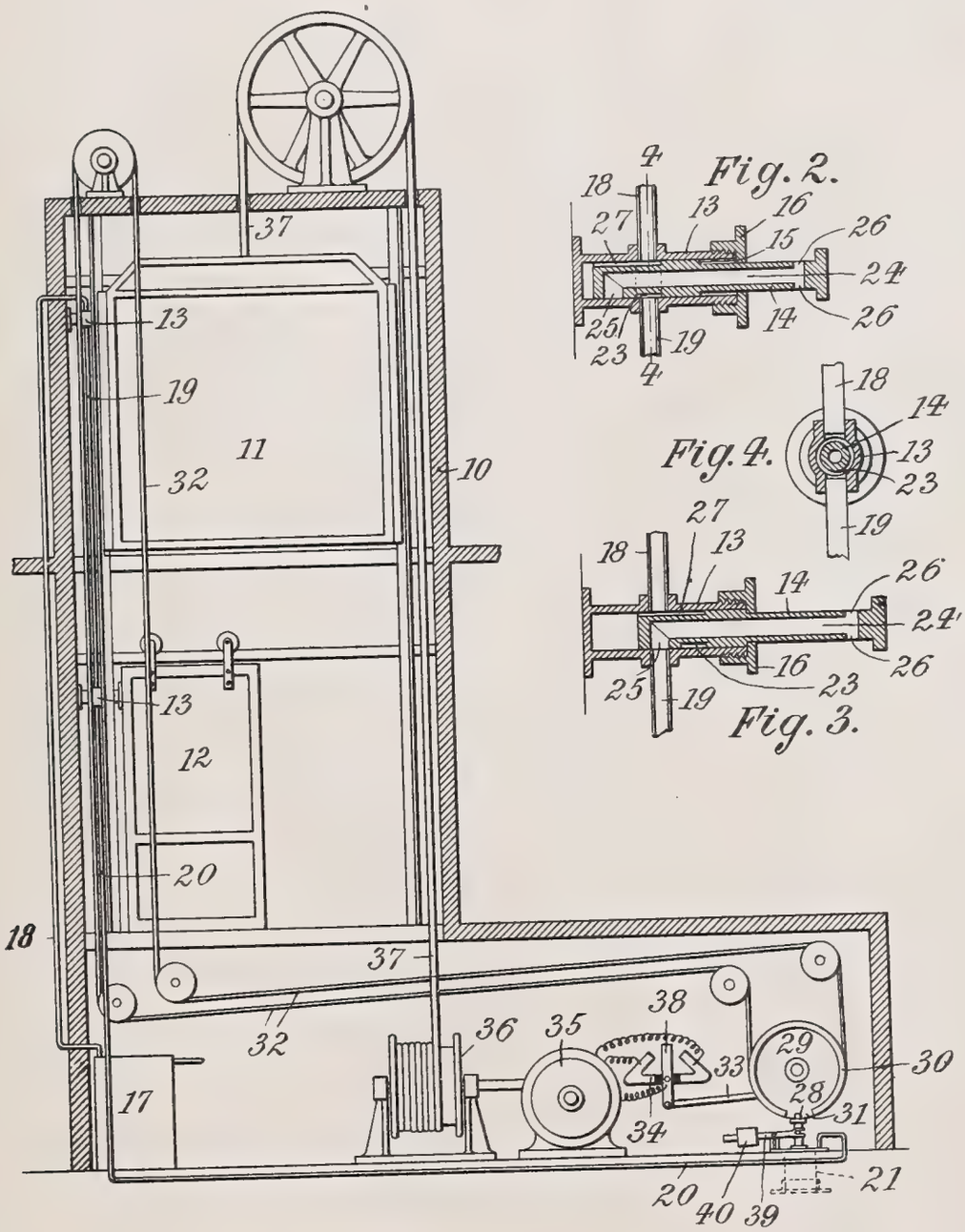

Fig. 2.

Fig. 4.

Fig. 3.

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William Schulz.

Inventor
Frederick William A. Wiesebrock
By his Attorney
Frank V. Briesen

THE NORRIS PETERS CO., WASHINGTON, D. C.

No. 897,566. PATENTED SEPT. 1, 1908.

F. W. A. WIESEBROCK.

SAFETY DEVICE FOR CONVEYANCES.

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2 SHEETS—SHEET 2.

Fig. 5.

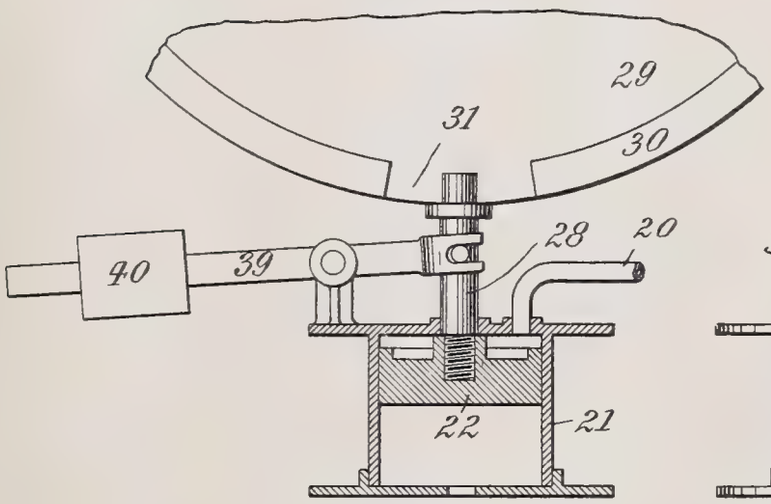
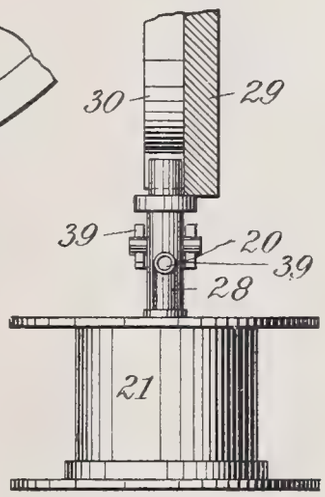


Fig. 6.



Witnesses:
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William Schulz.

Inventor
Frederick William A. Wiesebrock
By his Attorney
Francis T. Driscoll

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UNITED STATES PATENT OFFICE.

FREDERICK WILLIAM A. WIESEBROCK, OF NEW YORK, N. Y.

SAFETY DEVICE FOR CONVEYANCES.

No. 897,566. Specification of Letters Patent. Patented Sept. 1, 1908.

Application filed June 17, 1907. Serial No. 379,316.

To all whom it may concern:

Be it known that I, FREDERICK WILLIAM A. WIESEBROCK, a citizen of the United States, residing at New York city, (Bronx,) county and State of New York, have invented new and useful Improvements in Safety Devices for Conveyances, of which the following is a specification.

This invention relates to an improved device for automatically preventing the movement of elevators, trains and other conveyances, until all the doors leading thereto have been closed, so that accidents resulting from a premature starting of the conveyance are prevented.

In the accompanying drawings: Figure 1 is a vertical section through an elevator provided with my improved safety device; Fig. 2 a detail longitudinal section through one of the valves; Fig. 3 a similar view showing the plunger in a different position; Fig. 4 a cross section on line 4—4, Fig. 2; the mechanism shown in Fig. 5 is a front view, partly in section, of the power locking means, and Fig. 6 an end view, partly in section, of the mechanism shown in Fig. 5.

Within the shaft 10 of the elevator moves the car 11 accessible at every floor by a sliding door 12. Opposite each door there is secured to the frame thereof a cylindrical casing 13 in which is free to move a piston or plunger 14, which is adapted to be pushed inwards by the door when the latter is closed, the outward movement of the plunger being limited by the engagement of its shoulder 15 with a head 16. The casing 13 of the top floor receives compressed air from a tank 17 by a pipe 18, such air being conveyed to the casing 13 of the bottom floor by pipe 19. This lower casing, in turn, connects by pipe 20 with the cylinder 21 containing piston 22 of the power locking means. Plunger 14 is provided with a circumferential groove or port 23 that establishes communication between the compressed air pipes when the plunger is in its retracted position, *i. e.*, when the door is closed. Each piston is further provided with a longitudinal bore 24 having rear port 25 and front exhaust openings 26. A duct 27 of piston 14 further conveys the compressed air to the back of such piston so as to tend to force the latter outward. When piston 14 is retracted, groove 23 connects the compressed air pipes entering its casing 13, while port 25 is thrown out of connection with the lower one of such pipes, (Fig. 2). When the piston is advanced, groove 23 is moved out of communication with the compressed air pipes, while port 25 is brought into communication with the lower pipe, (Fig. 3).

Piston 22 carries a bolt 28 adapted to lock a wheel 29 which controls the movement of car 11 and is operated by hand-rope 32. Wheel 29 is provided with a circumferential flange 30, recessed or cut away as at 31 to accommodate bolt 28. As illustrated, wheel 29 operates by rod 33 the reversing switch 34 of an electro-motor 35 which rotates the drum 36 of the hoisting cable 37, but this construction may be varied for adaption to the particular operating means employed. The position of recess 31 is such that it will arrive opposite bolt 28 when the car is stopped, *i. e.*, when switch-knife 38 arrives in its central or neutral position. Piston 22 is, by a lever 39 engaging bolt 28 and carrying counter-weight 40, adapted to be raised so as to bring bolt 28 into engagement with wheel 29.

The operation is as follows: When all doors 12 of the elevator are closed, plungers 14 will be retracted and tank 17 will deliver compressed air through pipes 18, 19 and 20 and connecting grooves 23, into top of cylinder 21. Piston 22 will accordingly descend against action of weight 40, to withdraw bolt 28 from recess 31 and thereby liberate wheel 29. The motor is now started to move car 11 opposite the floor level desired, when it is stopped. When any one of the doors 12 is opened its plunger 14 will be advanced by the air pressure back thereof to disconnect the ingress and egress air pipes entering the casing 13 of such plunger. In this way tank 17 is cut off from cylinder 21 and the latter is brought by the air pipe into communication with port 25 of the dislodged piston 14, (Fig. 3). The compressed air will thus escape from the cylinder through said pipe and plunger out of the exhaust openings 26 to relieve piston 22 from pressure. Counterweight 40 will now raise piston 22 to carry its bolt 28 into engagement with recess 31 which has arrived opposite the bolt. Thus wheel 29 becomes locked and the elevator cannot be re-started until the open door has been closed and the pressure medium re-admitted to cylinder 21 by the retraction of the corresponding plunger.

It will be seen that by my invention automatic means are provided for preventing the

starting of the car as long as any one of the doors is open, so that accidents resulting from an untimely starting of the elevator are prevented. The drawing shows an elevator having two landings, but it is obvious that the latter may be multiplied to any extent desired. So also may the invention be applied to various other conveyances, such as electric and other trains, and wherever movement is to be prevented as long as access to such conveyance is unobstructed.

I claim:

A device of the character described, comprising a compressed air tank, a casing communicating therewith, an inclosed tubular door-controlled plunger having a circumferential groove and an exhaust port, a pipe adapted to communicate at one end with said groove and port, a cylinder communicating with the other end of the pipe, an inclosed piston, a wheel controlled by the piston, and means controlled by the wheel for operating a conveyance, substantially as specified.

Signed by me at New York city, (Manhattan,) N. Y., this 15th day of June, 1907.

FREDERICK WILLIAM A. WIESEBROCK.

Witnesses:

WILLIAM SCHULZ,

FRANK V. BRIESEN.

H. WATSON.

SAFETY ELEVATOR.

APPLICATION FILED DEC. 27, 1907.

899,362. Patented Sept. 22, 1908.

4 SHEETS—SHEET 1.

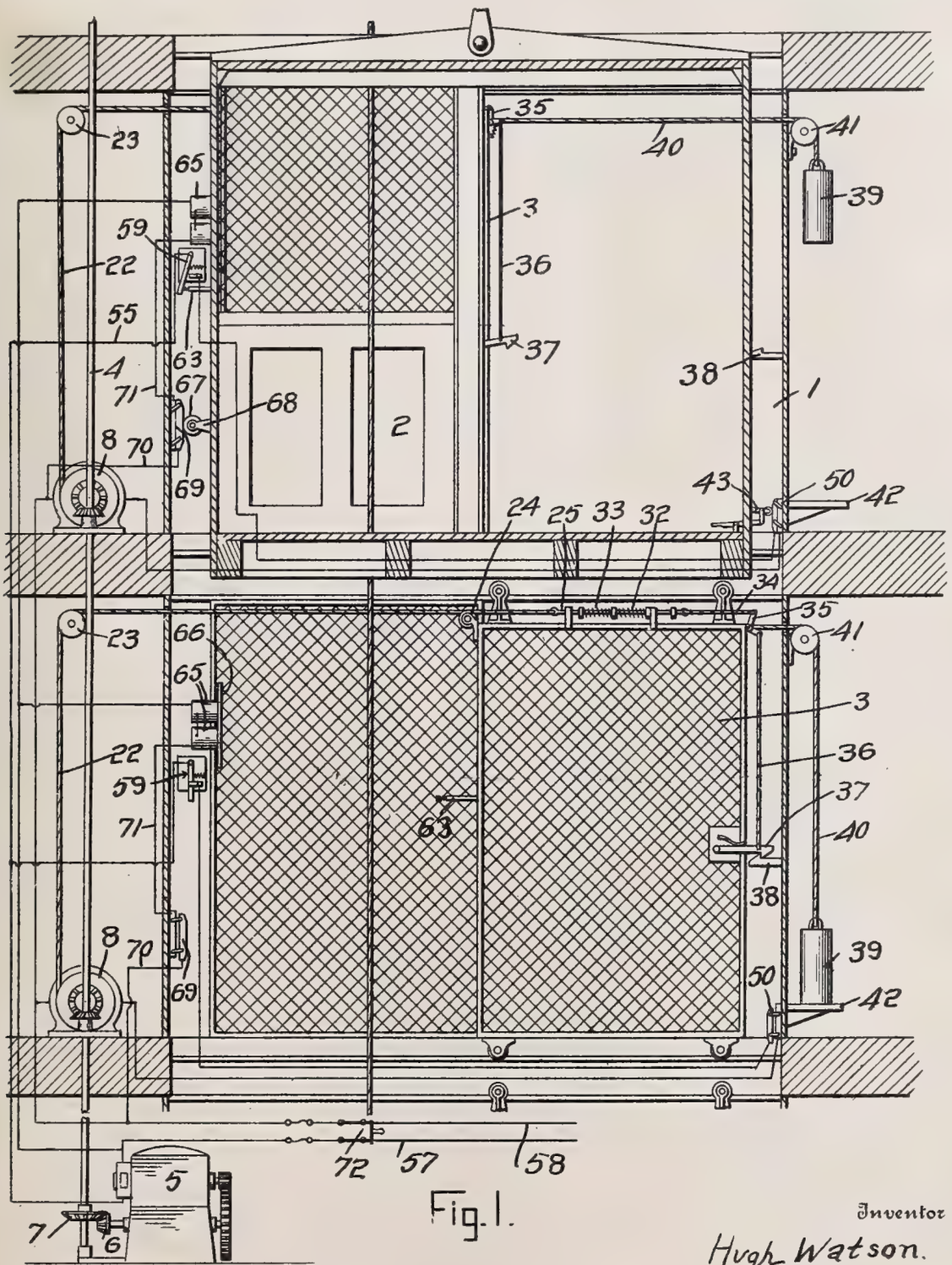

Fig. 1.

Witnesses

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SAFETY ELEVATOR.

APPLICATION FILED DEC. 27, 1907.

899,362. Patented Sept. 22, 1908.

4 SHEETS—SHEET 2.

Fig. 2.

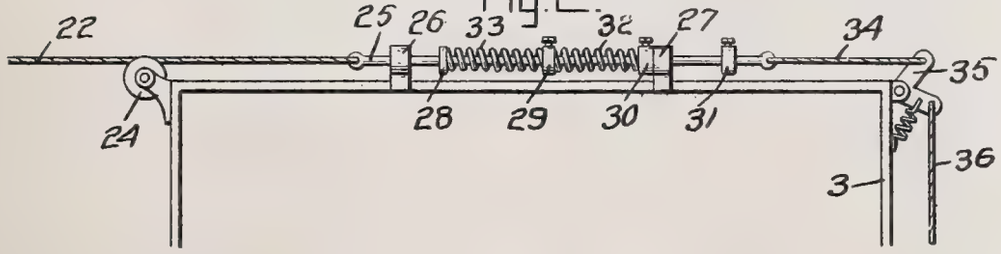


Fig. 3.

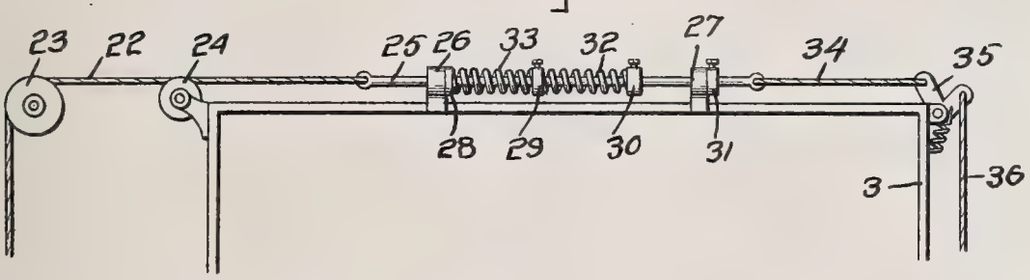


Fig. 4.

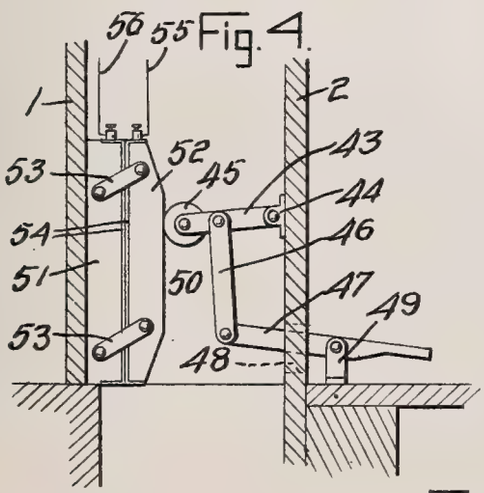


Fig. 5.

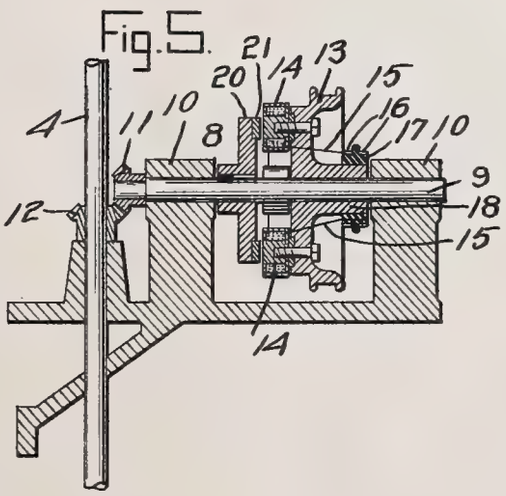
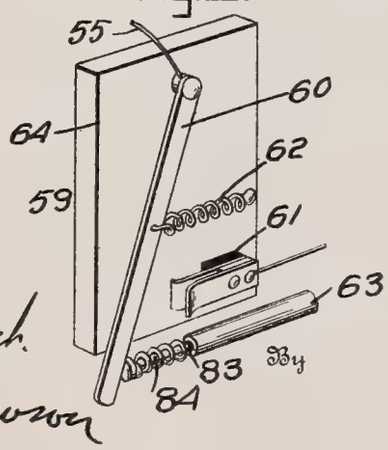


Fig. 6.



Witnesses

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SAFETY ELEVATOR.

APPLICATION FILED DEC. 27, 1907.

899,362. Patented Sept. 22, 1908.

4 SHEETS—SHEET 3.

Fig. 7.

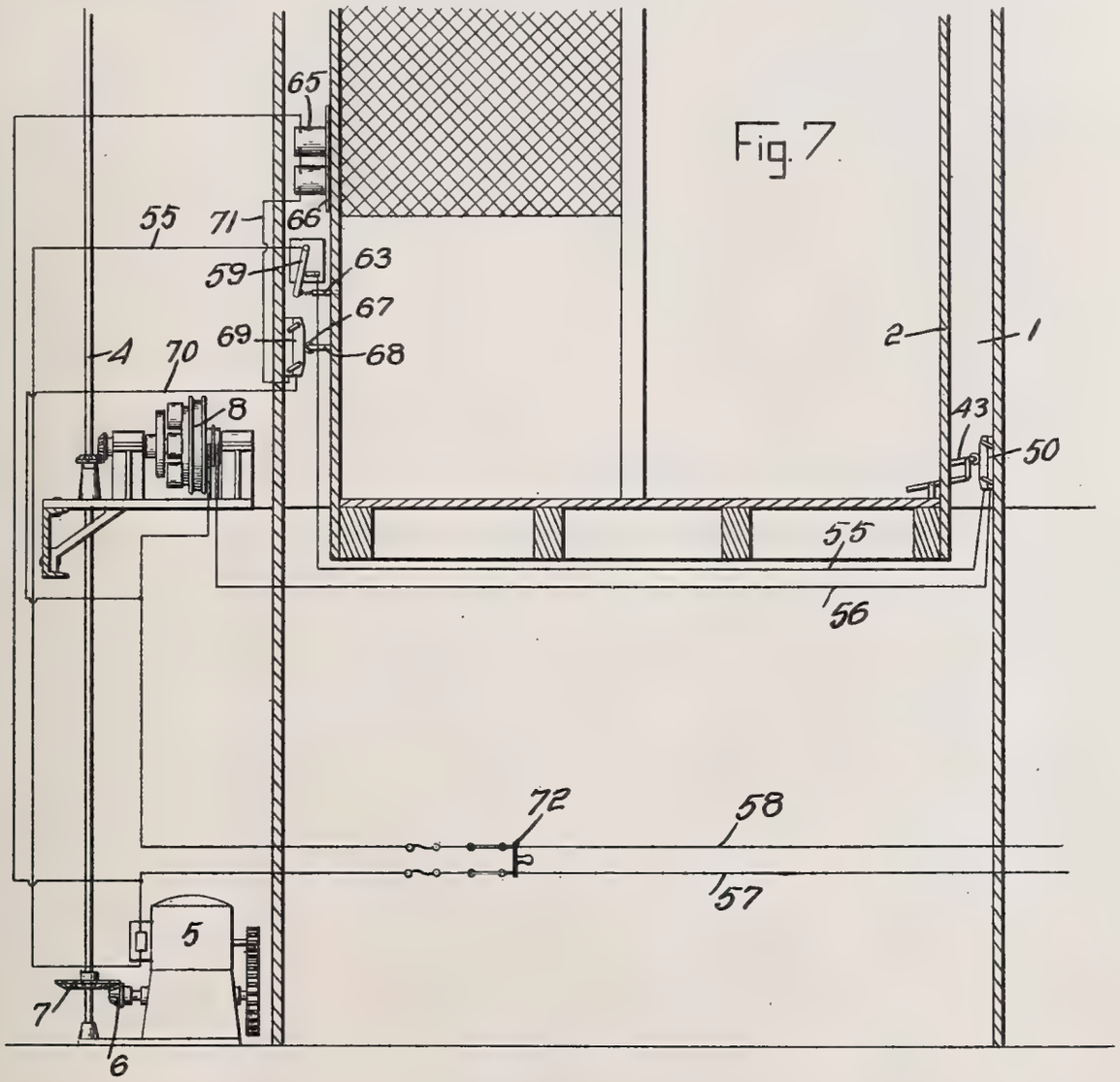
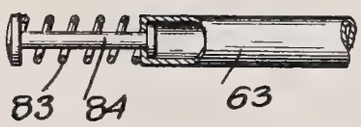


Fig. 9.



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SAFETY ELEVATOR.

APPLICATION FILED DEC. 27, 1907.

899,362. Patented Sept. 22, 1908.

4 SHEETS—SHEET 4.

Fig. 8.

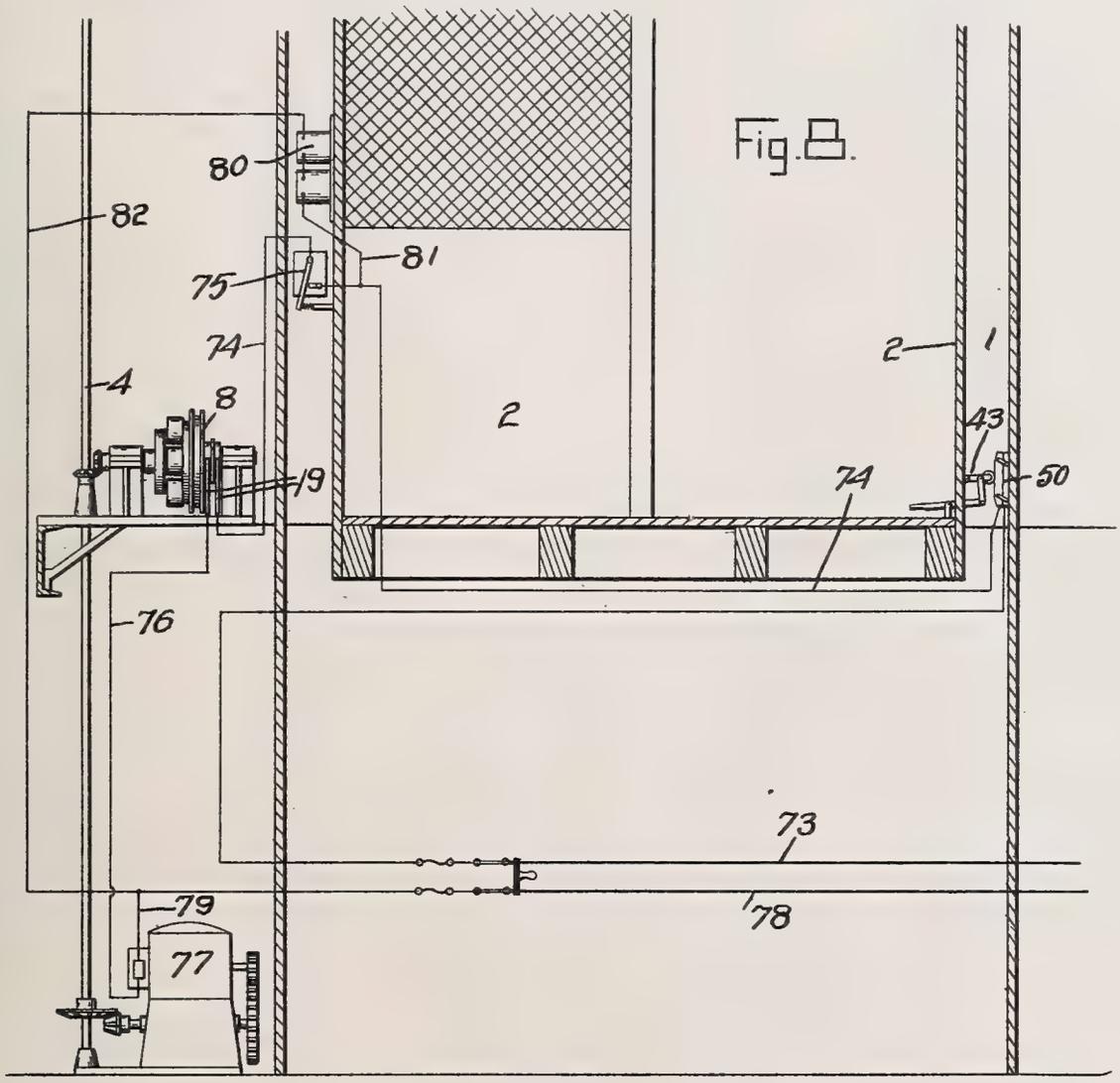
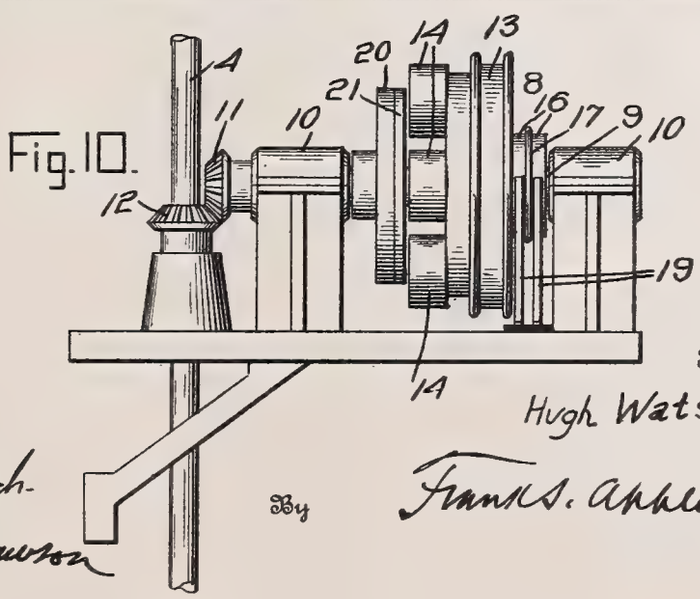


Fig. 10.



Witnesses

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UNITED STATES PATENT OFFICE.

HUGH WATSON, OF WASHINGTON, DISTRICT OF COLUMBIA.

SAFETY-ELEVATOR.

No. 899,362. Specification of Letters Patent. Patented Sept. 22, 1908.

Application filed December 27, 1907. Serial No. 408,286.

To all whom it may concern:

Be it known that I, HUGH WATSON, a citizen of the United States of America, residing at the city of Washington, in the District of Columbia, have invented certain new and useful Improvements in Safety-Elevators, of which the following is a specification.

This invention relates to new and useful improvements in devices for opening and closing elevator doors and it has relation more particularly to devices which remain inoperative until the car has reached a predetermined point.

It is an object of the invention to provide a novel device of this character wherein an electrical contact may be made when the car has reached the floor to operate a mechanism which will open the door.

It is also an object of the invention to provide novel means in a device of this character whereby simultaneously with the closing of the circuit for opening the door a means will be made operative for holding said door open.

It is also an object of the invention to provide in combination with a device of this character, novel means whereby the circuit for controlling the opening of the door will be broken before the door has reached the limit of its movement.

It is also an object of the invention to provide a novel device of this character wherein the various doors of the elevator-well or shaft are caused to open by a common motor, each door having its individual clutch operating in conjunction with a shaft operated by the motor.

It is also an object of the invention to provide a novel device of this character wherein the various elements required for the successful operation of the device in opening a door and holding said door opened are made operative from a single contact.

Finally an object of this invention is to produce a novel device of the character noted, which will possess advantages in points of simplicity, efficiency and durability, proving at the same time comparatively inexpensive to manufacture and maintain.

With the foregoing and other objects in view, the invention consists in the details of construction and in the arrangement and combination of parts to be hereinafter more fully set forth and claimed.

In describing the invention in detail, reference will be had to the accompanying drawings forming part of this specification wherein like characters denote corresponding parts in the several views in which —

Figure 1, is a vertical section of a portion of a well-hole or shaft showing the door on one floor open and the door on another floor closed, the car being shown in section; Fig. 2, is a side elevation of the upper portion of a door showing a portion of the unlocking mechanism in the position when the door is closed; Fig. 3, is a view similar to Fig. 2, except that the unlocking mechanism is shown in the position assumed when the door is unlocked; Fig. 4, is a side elevation of the mechanism employed for setting the motor in operation to unlock and open the door; Fig. 5, is a sectional view of the clutch employed in the operation of the device; Fig. 6, is a perspective view of the cut-out employed for controlling the operation of the clutch; Fig. 7, is an enlarged sectional view setting forth the various connections required for the successful operation of the invention; Fig. 8, is a view similar to Fig. 7, illustrating a modified form of wiring wherein the various parts are made operative from a single contact; Fig. 9, is a fragmentary sectional view illustrating a detail of the invention; and Fig. 10, is a view in elevation of the combined clutch and winding drum.

In the drawings 1, denotes the well-hole or shaft, 2, the car and 3, the doors, all of which may be of any approved construction.

At one side of the well-hole 1, mounted in suitable brackets is the shaft 4, which is rotated by a motor 5, through the medium of the gears 6 and 7. This motor may be positioned anywhere intermediate the length of the shaft but it has been found best in practice to have the same located within the basement of the building.

On each floor adjacent the shaft 4, and at one side of the well-hole 1, is a combined clutch and drum 8. This combined clutch and drum may be supported in its proper position in any desired manner as this forms no essential feature of the invention. In its construction, the combined clutch and drum comprises a driving shaft 9, mounted in suitable bearings 10. One end of this shaft projects beyond one of the bearings and is provided with a beveled gear 11, meshing with a beveled gear 12, on the shaft 4. It will thus

be seen that with the rotation of the shaft 4, the driving shaft 9, will be rotated thereby. Loosely mounted on the shaft 9, is the winding drum 13. This drum has secured thereto a series of magnets 14 and these magnets are connected by the wires 15, with the contact rings 16, embracing the insulating sleeves 17, carried by the hub 18, of the drum. These rings in turn are contacted with by the brushes 19, suitably connected with a proper source of electricity. Keyed to the shaft 9, but capable of longitudinal movement thereon, is the disk 20, provided on its face opposed to the magnets with a soft iron ring 21. When proper electrical connection is made, the magnets 14, will become energized and draw thereto the disk 20, and as long as this connection is maintained the drum 13, will be caused to rotate with the rotation of the shaft 9.

Secured to the winding drum at one end is the drawing member 22. This member is illustrated in the drawings as being a cable, but it is to be understood that any flexible device which will operate with equal facility may be substituted therefor. This cable 22, passes over the pulleys 23 and 24 and is secured to an end of a rod 25, mounted in the brackets 26 and 27.

Located on the rod 25, are the collars 28, 29, 30 and 31, the collar 28, being loose on the rod, and collars 29, 30 and 31, being provided with set screws by means of which they may be adjusted to any desired position. Situated between the collars 29 and 30, is a spring 32, and between the collars 28 and 29, is a spring 33. The purpose of the springs is to cushion the stroke of the rod 25, as it slides in the brackets 26 and 27. Attached to the forward end of the rod 25, is an end of a flexible member 34, the opposite end of said member being secured to the upper arm of a spring-restrained angle-lever 35, pivoted to one corner of the door. Secured to the other arm of the angle lever is one end of a flexible connection 36, the opposite end of said connection being attached to a spring-pressed latch 37, which is intended to engage a keeper 38, secured to the wall of the well-hole. It will thus be seen that when the winding drum 13, is rotated, the door will be unlatched and caused to open. When the winding drum 13, has been released from the disk, the weight 39, will cause the door to close. This weight 39, is attached to a flexible member 40, secured to the forward edge of the door. This flexible member 40, passes over a pulley 41.

In order to prevent sudden shock or jar to the door in closing, a buffer or cushion 42, is provided to relieve the strain of the weight from the door when it has reached the limit of its necessary drop.

Carried by the car 2, is a lever 43, said lever being pivotally connected to the bracket 44, secured to an outer surface of the car. Mounted in the free end of this lever 43, is a roller 45, for a purpose to be hereinafter referred to. Intermediate its length, the lever 43 has pivoted thereto an end of a link 46, which has its opposite end pivoted to the outer portion of a foot lever 47, which extends through an opening 48, in the car. This foot lever 47, is pivotally secured intermediate its length to a bracket 49, secured to the base or floor of the car. By this arrangement, the lever 43, may be moved on its pivot.

The roller 45, is intended to engage a contact 50, in order to close the required circuits for opening the door. There is a contact 50, for each door and said contact is secured to a wall of the well-hole and is so positioned that the roller 45, may contact therewith only when the car 2, is in proper alinement with the floor for the discharge or admission of passengers. This contact 50, may be of any desired construction, but it has been found best to form the same of two pieces 51 and 52. The piece 51, is secured to the wall of the well-hole while the piece 52, is movable eccentrically with relation to the piece 51, through the medium of the links 53, pivoted to the piece 51, and the piece 52, more particularly shown in Fig. 4. These pieces are formed of non-conductive material and have their opposed or contacting edges faced with conductor strips 54, to which wires 55 and 56 are connected, the wire 55, being connected to the movable member while the wire 56, is connected with the stationary member. The wire 56, is in connection with one of the brushes 19, of the clutch. The wire 55, leads to the motor 5. The wire 57, of the main line is also in connection with the motor. The wire 58, of the main line is in connection with the second brush 19, of the clutch. By this arrangement, it will be seen that when the car has been stopped at the proper floor, and the operator presses the foot lever 49, the roller 45, will force the contact piece 52, against the piece 51, and thereby close a circuit through the wires 58, 56, 55 and 57, which contact will cause the motor 5, to rotate the shaft 4, and energize the magnets 14, which will effect the desired rotation of the winding drum 13, and thereby cause the door to open as will, it is thought, be fully understood.

The line 55, is interrupted by a switch 59. This switch may be of any structure which will meet the necessities of practice and it has been found desirable to employ the form shown in Fig. 6, wherein the pivoted blade 60, normally engages the contacts 61, said engagement being maintained through the medium of the contraction spring 62. This switch forms an essential feature of the invention as this switch breaks the circuit and stops the rotation of the winding drum 13, when the door has been caused to open suffi-

ciently. The switch depends upon the door for its operation.

Extending rearwardly from the door is an arm 63, which is in a line with the blade 60, and is intended to contact therewith, said blade being preferably extended beyond an edge of the base block 64, of the switch. The arm 63, contacts with the blade 60, just before the door has reached the limit of its movement and forces the blade out of engagement with the contact 61, and thereby breaks the circuit, which will consequently stop the motor and free the winding drum from the disk 20.

Under ordinary circumstances, the weight 39, would cause the door to close immediately upon the breaking of the circuit, but to hold the doors open until the car leaves its position, the magnets 65, are carried by the well-hole and are intended to, contact with the rear edge of the door or a metallic strip 66, carried thereby. When the car is in position, these magnets are inactive, but when the car has stopped at the floor, the roller 67, carried by the arm 68, projecting rearwardly from the car closes the contact 69, said contact being of the same construction as the one hereinbefore referred to.

The movable member of the contact is connected with the main wire 58, by the wire 70, while the immovable member is connected with the magnets by the wire 71, said wire being continued and connected with the wire 57, of the main line. Thus it will be seen that when the contact 69, is closed, the magnets are energized. When the car is moved, the contact 69, separates as soon as the roller 67, passes therefrom.

From the foregoing description, it will be seen that unless the device is in operation, there is no waste of electricity. When the time comes for the closing down of the elevator, the main line circuit may be broken by the switch 72, when the door will close. Access may be had to the car by the operator in the usual way by a key or the like, it being understood that the mechanism hereinbefore referred to will not interfere with the gate being operated manually.

It has been found in the successful operation of the invention that it is well to control the operation of the magnets 65, by the contact used in conjunction with the foot lever. This arrangement is more particularly shown in Fig. 8. In this form the wire 73, of the main line is connected with the stationary member of the contact while the movable member of the contact is connected by the wire 74, with one of the brushes of the clutch, said wire 74, being interrupted by a switch 75 as in the form hereinbefore referred to. The second brush of the clutch is connected by a wire 76, with the motor 77, said motor being connected with the wire 78, of the main line by the wire 79. The magnets 80, are connected with the wire 74, by the wire 81, and with the wire 78, of the main line, by the wire 82. It will therefore be seen that when the pieces of the contact are in engagement, circuits will be formed for the motor, clutch, and the magnets, and that when the switch 75 is broken, a circuit will still be maintained for the magnets and that the said magnets will be energized as long as the pieces of the contact are held in engagement one with the other.

While not essential, it has been found advantageous to have the contacting end of the arm 63, cushioned. This cushioning may be effected in any manner but it has been found desirable to have a telescoping member 84, which is held at the limit of its outward movement by the coiled spring 83.

The device as hereinbefore set forth has been described in conjunction with a well-hole wherein each floor has but one door. It is to be understood, however, that a multiplicity of doors may be operated by the present device with equal facility, the slight changes which may of necessity accrue, easily fall within the scope of a skilled mechanic.

I claim:

1. In combination with an elevator shaft and its doors, a car, a winding drum for each door, a flexible connection between each drum and its door whereby the drum will move the door in one direction, and a means common to all the doors for rotating the drums.

2. In combination with an elevator shaft and its doors, a car, a winding drum for each door, a flexible connection between each drum and its door whereby the drum will move the door in one direction, a means common to all the doors for rotating the drums, and means whereby the operating means is made inoperative when the door has been moved a predetermined distance.

3. In combination with the doors of an elevator shaft, a car, a winding drum for each door, a flexible connection between each drum and the door to be operated by the drum, means for transmitting power to the drums, and electrically controlled means for intermittently connecting the drums to the power transmitting means.

4. In combination with the doors of an elevator shaft, a car movable with relation to the doors, means for operating the doors, a motor independent of the car moving motor for actuating the door operating means, and electrically controlled devices for connecting the door operating means with the actuating means.

5. In combination with the doors of an elevator shaft, a car movable in the shaft, means for holding the doors normally closed, door opening means comprising an electrically controlled clutch stationed in operative

relation to each door, a source of power for rotating one member of each clutch, and means for electrically connecting the parts of any one clutch independently of the other clutches, whereby one door opening means may be operated independently of the other door opening means.

In testimony whereof, I affix my signature in the presence of two witnesses.

HUGH WATSON.

Witnesses:
WM. J. KNOBLOCH,
WILFRED E. LAWSON.

P. F. FOLEY.

SAFETY MECHANISM FOR ELEVATORS.

APPLICATION FILED FEB. 17, 1905.

900,158. Patented Oct. 6, 1908.

3 SHEETS—SHEET 1.

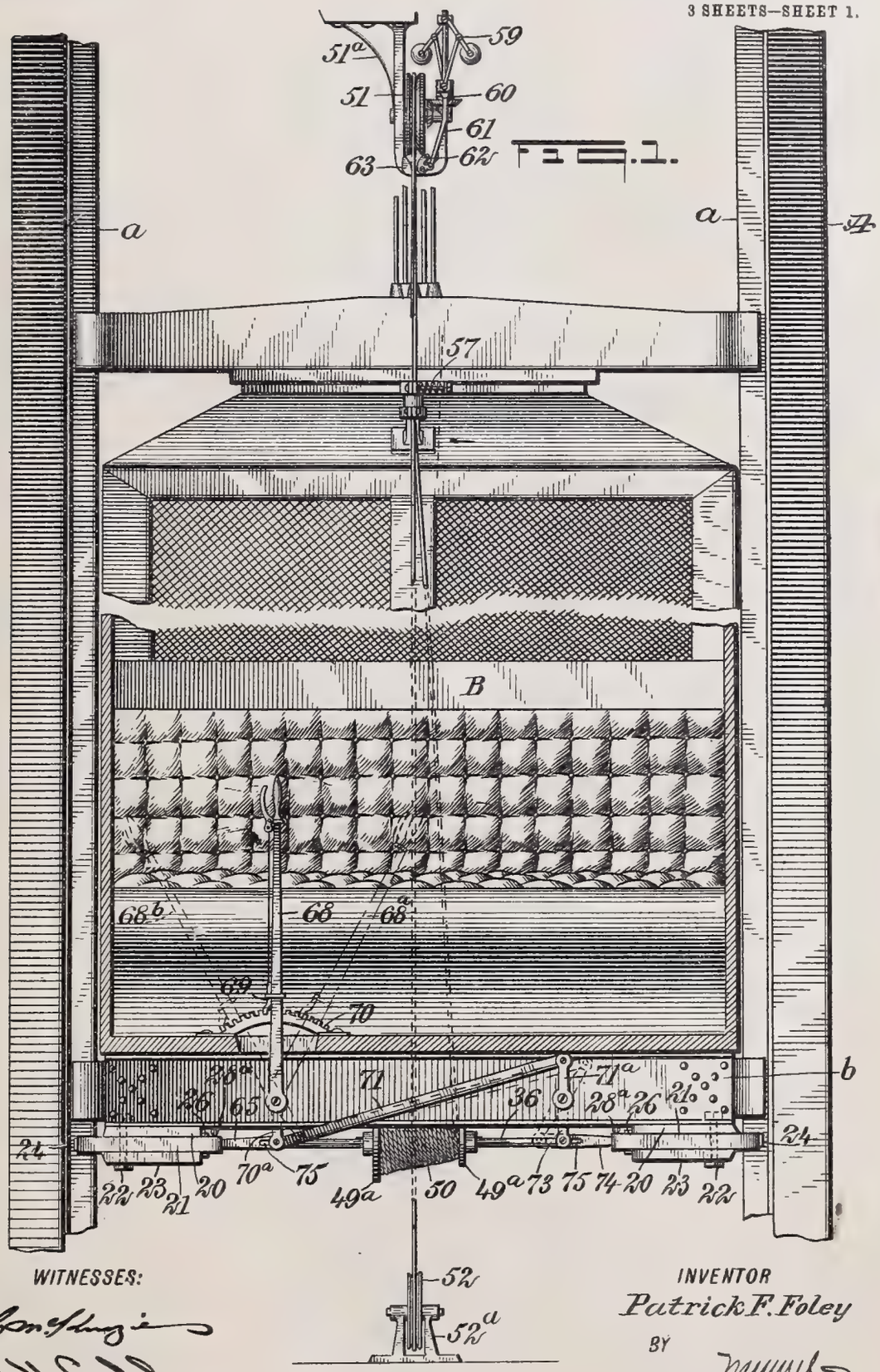

FIG. 1.

WITNESSES:

INVENTOR

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BY

ATTORNEYS

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SAFETY MECHANISM FOR ELEVATORS.

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3 SHEETS—SHEET 2.

FIG. 2.

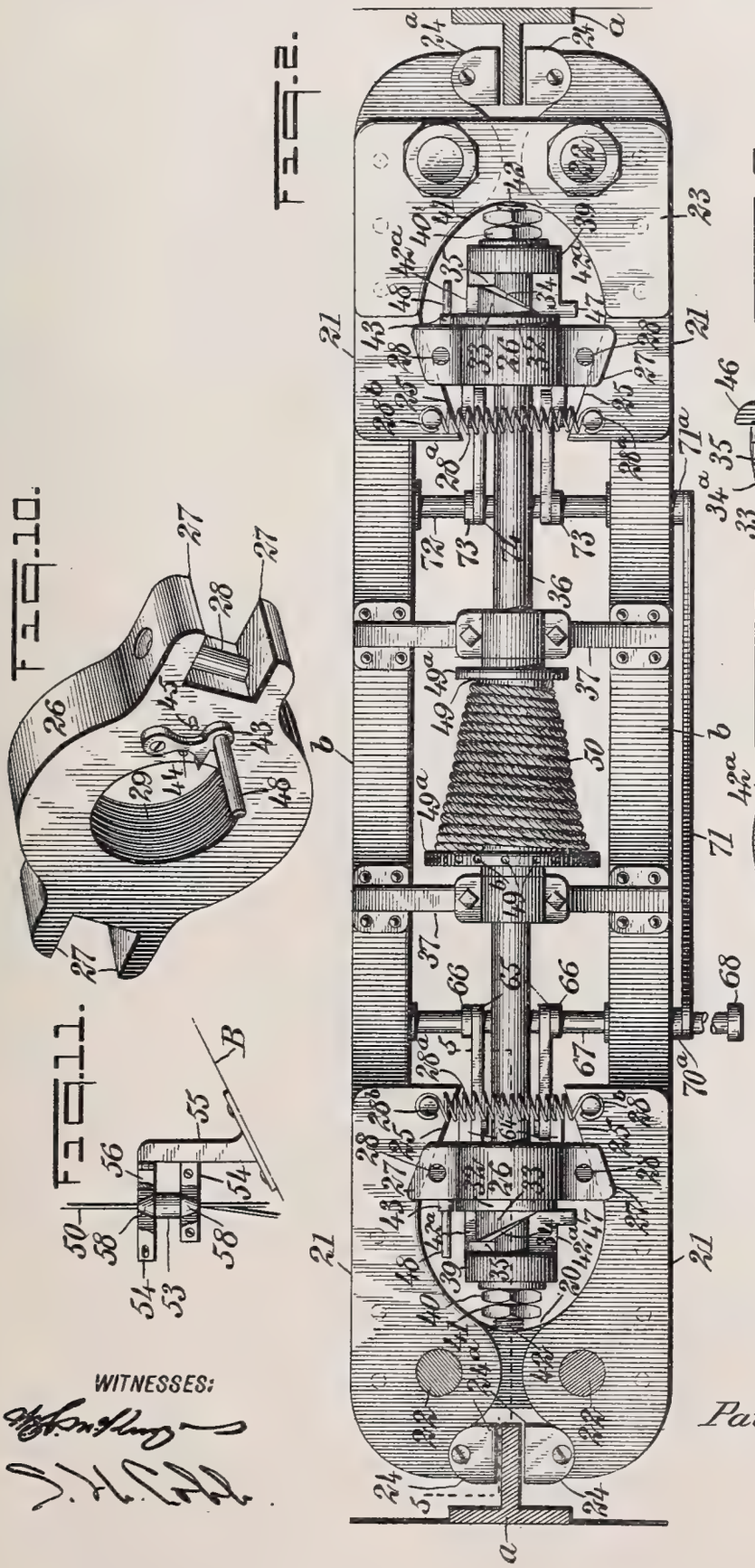

FIG. 8.

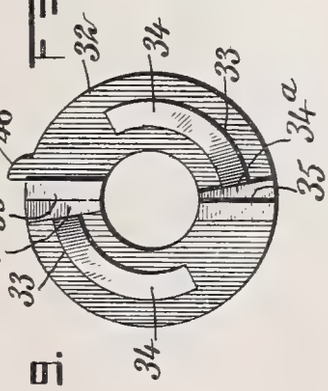

FIG. 9.

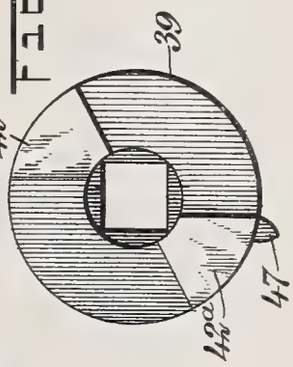

FIG. 10.

FIG. 11.

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P. F. FOLEY.

SAFETY MECHANISM FOR ELEVATORS.

APPLICATION FILED FEB. 17, 1905.

900,158. Patented Oct. 6, 1908.

3 SHEETS—SHEET 3.

Fig. 3.

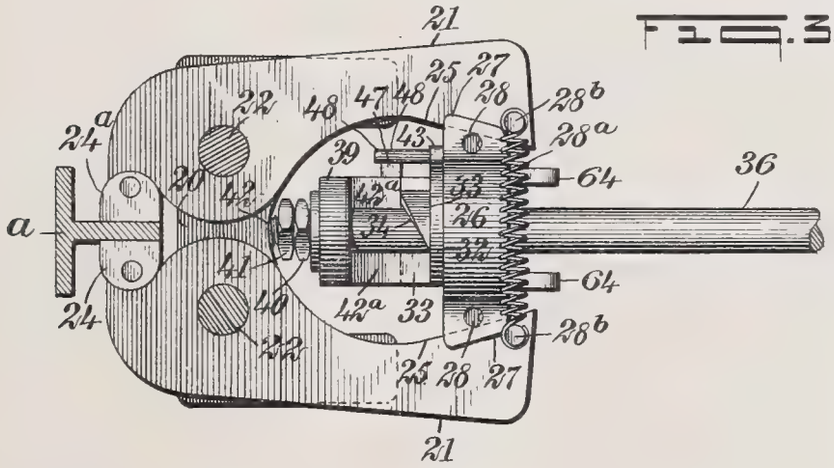


Fig. 4.

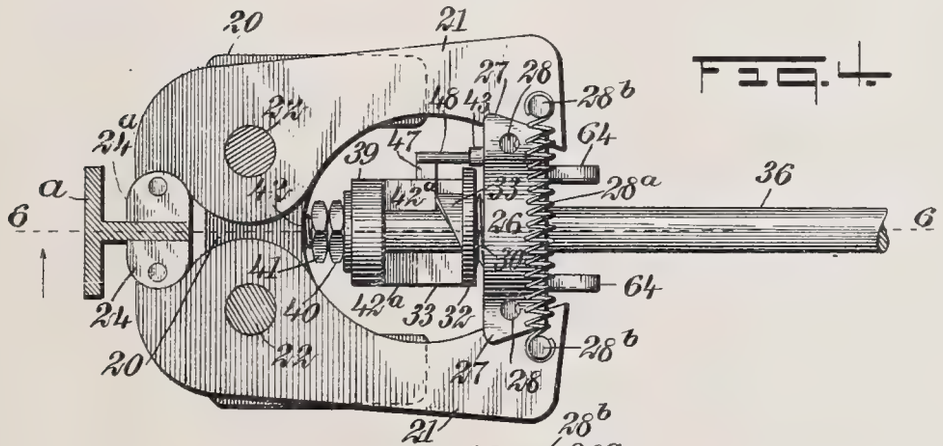


Fig. 5.

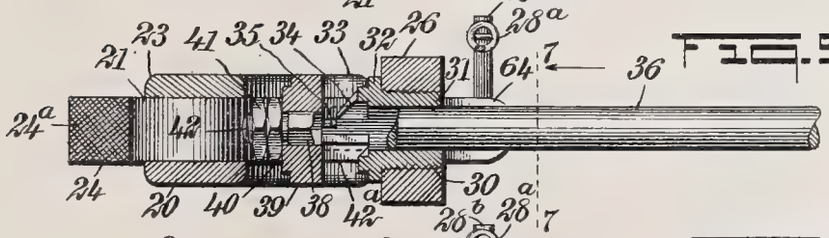


Fig. 6.

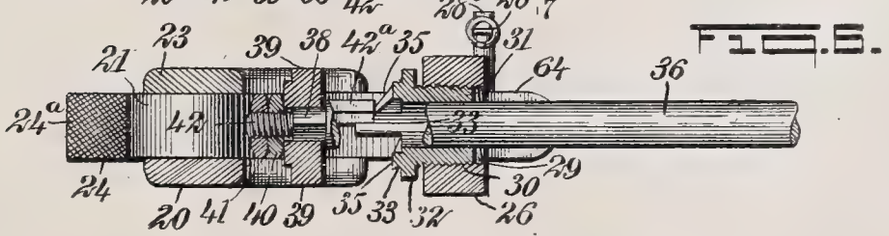
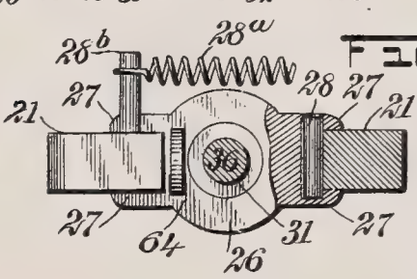


Fig. 7.



WITNESSES:

INVENTOR

Patrick F. Foley

BY

ATTORNEYS

THE NORRIS PETERS CO., WASHINGTON, D. C

UNITED STATES PATENT OFFICE.

PATRICK F. FOLEY, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO CHARLES W. HOFFMAN, OF NEW YORK, N. Y.

SAFETY MECHANISM FOR ELEVATORS.

No. 900,158. Specification of Letters Patent. Patented Oct. 6, 1908.

Application filed February 17, 1905. Serial No. 246,040.

To all whom it may concern:

Be it known that I, PATRICK F. FOLEY, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented a new and Improved Safety Mechanism for Elevators, of which the following is a full, clear, and exact description.

My invention relates to mechanisms for arresting the movement of an elevator which has, from any cause, attained an excessive speed. Its principal objects are to provide positive and automatic means for quickly bringing this safety mechanism into position for application and then, by a continuation of this movement, more gradually effecting its engagement, and to enable the mechanism to also be manually operated without interference with its automatic action.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a broken sectional elevation of an elevator-car and a portion of the shaft in which it moves; Fig. 2 is a bottom plan view of the safety mechanism, parts being broken away and the guide-rails being shown in section; Fig. 3 is a similar view of one end of the safety mechanism but with the jaws brought into proximity with the rail; Fig. 4 shows the same elements in the position for effecting engagement; Figs. 5 and 6 are vertical longitudinal sections on the lines 5—5 of Fig. 2 and 6—6 of Fig. 4, respectively; Fig. 7 is a transverse sectional detail on the line 7—7 of Fig. 5; Figs. 8 and 9 show, in end elevation, the coacting portions of the actuating member and the adjacent rotatable member; Fig. 10 is a perspective view of the operating member; and Fig. 11 is a detail in broken side elevation of the stop-button and its more closely associated elements.

Upon the walls of a shaft A are supported the usual vertical guide-rails *a*, *a*, which may also serve as the fixed contact members of the safety mechanism. In this shaft moves a car B operated in any usual or convenient manner and having, across its lower portion, beams *b*, *b* spaced some distance apart. These beams serve to support the more essential elements of my improved mechanism, which is illustrated as substantially duplicated at opposite sides of the car for coöperation with both rails. As these sets of elements are the same, save that their inclined threaded or cam portions may be reversed to secure similar operating movements from a rotatable member common to both, but one will be particularly described. Considering, then, one side of the car, there is attached to the ends of the beams adjacent to the guide-rail a plate 20 cut away at its central portion to avoid interference with the movable portions of the mechanism. Upon this plate is fulcrumed a pair of levers 21, 21, by means of bolts 22, which also support a bottom-plate 23 upon which the levers rest. At the outer end of each lever is a pivoted contact member or jaw 24, the face 24^a, which coöperates with the rail, being shown as roughened to secure more effective engagement. The inner adjacent edges of the levers are inclined at 25, they converging inwardly and furnishing contact surfaces. Between these faces is situated an operating member which comprises a body 26, from opposite sides of which extend pairs of arms 27, 27 overlapping the levers and being supported and guided thereon. Between the arms are lateral recesses in which are rotatably mounted rolls 28 which coact with the contact-faces 25 of the levers and serve to reduce the friction between these elements. The levers may be drawn into contact with these rolls, they being thus held with the jaws separated for a suitable distance from the rail, by a spring 28^a connecting studs 28^b depending from the under side of the levers near their extremities. In the operating member is shown an axial opening, which is threaded at 29, and with this thread coacts a threaded portion 30 of an actuating member or sleeve 31. This sleeve has, at its opposite or outer end, a head 32 overhanging the adjacent face of the operating member and being provided with opposite extensions 33, 33, each of which has an inclined contact or cam-face 34 which is, in effect, a portion of a screw-thread of much greater pitch than that formed upon the sleeve at 30. Each of these cam-faces leads to a face 34^a situated substantially parallel to the head of the sleeve and terminates in a vertical stop-face 35. Through the operating member and sleeve extends an operating shaft 36 mounted to rotate in bearings carried by bars 37, 37 extending between the beams *b*. This shaft projects beyond the sleeve and is squared at 38 to receive a collar 39, which, by its squared engagement, is con-

strained to rotate with the shaft while being permitted longitudinal adjustment thereon. Its position with respect to the outer end of the shaft is fixed by a nut 40, which, with a lock-nut 41, is carried by the threaded end 42 of the shaft. From the inner side of the collar 39 project a pair of separated arms 42^a which coact with the contact-faces of the sleeve.

Pivoted upon the outer face of the operating member is a pawl 43 movable between inner and outer stop-pins 44 and 45 and in its inner position engaging a projection 46 from the periphery of the sleeve-head, this preventing the rotation of the sleeve. To disengage the pawl from the projection and allow the sleeve to rotate, a projection 47 is provided at one side of one of the arms 42^a, and when it revolves with the arm, contacts with a pin 48 extending laterally from the pawl, forcing it outward beyond the projection 46. Fixed upon the shaft 36 near its center is a drum 49, which, in the present instance, is shown as tapered from one end to the other. About this drum, between opposite heads 49^a, is wound an operating cable 50 which has one end attached to the drum and then passes upwardly over a pulley 51 mounted upon a bracket 51^a at the top of the shaft; then downwardly over a pulley 52 rotatable in a bracket 52^a fastened at the bottom of the shaft, and finally upwardly, where its other end is secured to a stop or controlling-button 53 fixed on the cable between the drum and pulley 51 and normally located between arms 54 projecting from a bracket 55 which is shown as mounted upon the top of the car. Coacting with each of the arms 54 is a pivoted arm 56 which is normally held in proximity to the companion arm by a spring 57 carried by the car. The button is preferably provided with inclined ends 58 resting in similarly formed recesses between the arms so that, if the movement of the cable is arrested, the button will force its way between the arms, thus releasing its engagement with the car. Carried by the bracket 51^a is a governor 59 of any convenient type, which is connected to the shaft of the pulley 51 by some such gearing as the bevel-pinion 60. An arm 61 is moved by this governor and is connected to a grip member 62 pivoted upon the bracket, and when the pulley 51 rotates at an abnormal speed, acting, by the movement of the governor, to clamp the operating cable between it and a companion member 63 fixed upon the bracket.

Under rates of travel of the car not much exceeding the normal the grip member 62 will be out of contact with the operating cable and the stop-button held between its coöperating arms will move the cable with the car, this passing over the pulleys at the top and bottom of the shaft without rotating the drum and operating-shaft. At this time the arms of the collar 39 are at the lower ends of the cam-faces upon the sleeve and the pawl is in engagement with the projection 46. This allows the operating member to occupy its extreme outward position, it being held there by the pressure of the lever-inclines under the tension of the connecting spring, which also holds the lever-jaws separated from the guide-rail by such a distance that they are not liable to come into contact with it during the movement of the car. If the car falls or attains an undue velocity the governor acts to grip the operating cable between the members 62 and 63, thus holding it against movement with the car. The operating-button then forces its way between the arms 54 and 56, pressing the latter to one side and permitting the cable to rotate the drum, the direction of its inclination giving it a gradually-decreasing speed. This causes the arms 42^a to ride up the inclines of the actuating-sleeve, which is held against rotation by the pawl and therefore forces both the actuating member and operating member longitudinally of the shaft and the latter against the levers, which are quickly swung sufficiently upon their fulcrums to bring the jaws into close proximity with the rail. This having been accomplished during a comparatively short travel of the car, the arms reach the stop-faces of the sleeve and at this time their projection strikes the pawl-pin, moving it outward and releasing the projection 46. The sleeve is now free to rotate with the arms and this turns it in the operating member, the threaded engagement causing the latter to act as a nut, it moving longitudinally but at a much less speed, thus slowly forcing the lever-arms from one another and the jaws into engagement with the rail. The pressure of the jaws increasing as the car advances gradually brings it to rest. It is also desirable that the operator shall be able to manually stop the car independently of its ordinary starting and stopping mechanism in event of its becoming uncontrollable. For this purpose each operating member has projections 64, here shown as two in number and situated upon its inner face at each side of the shaft. To these projections, at one side of the car, are articulated links 65 which, at their inner ends, are pivoted to arms 66 depending from a rock-shaft 67 which is shown as journaled in the beams *b*. Upon one end of the rock-shaft is a lever 68 projecting through the car-floor and having latch mechanism 69 by means of which it may be locked in position by engagement with a toothed sector 70. An arm 70^a on the shaft 67 is connected by a link 71 to an arm 71^a fixed upon a rock-shaft 72 at the opposite side of the car, and this shaft 72 also has fixed upon it and depending beneath the beams, similarly to the arms 66, rock-arms 73 which are

joined by links 74 to the projections 64 from the operating member at this side of the car. It is quite essential that the movement of the hand-lever shall in no wise interfere with the automatic operation of the safety mechanism, and to avoid this a slotted connection is provided between the elements at each side of the car. As illustrated, these slots 75 are formed in the links 65 and 74, where they are articulated to the rock-arms 66 and 73. The thrust of the lever in the manual application of the safety mechanism comes against the inner ends of the slots, thus leaving the links perfectly free to move independently of the automatic mechanism.

Normally the hand-lever would occupy the position indicated in dotted lines at 68^a in Fig. 1 of the drawings. In application the operator would swing the lever outwardly, and when it reaches a position substantially that shown in full lines the jaws will have been moved into close proximity with the rails, and upon a further outward movement of the lever toward the position indicated in dotted lines at 68^b they will be brought into operative engagement with said rails to check the movement of the car. Because of the slot-connection between the elements just described, if the efforts of the operator to stop or control the car are ineffective and it attains an excessive speed, the safety mechanism will still be free to work independently. After the jaws have been automatically set upon the rails to stop the car, they may be again released by inserting a suitable rod in openings 49^b in the periphery of the larger of the heads 49^a. A comparatively slight angular movement of the shaft 36 frees the ends of the arms 42^a from the face 34^a, when the clutch of the jaws is at once slackened. Then, as the arms run down the cam-faces 34, it is a very easy matter to continue the rotation of the drum until the parts assume their normal positions.

It will be seen that with my improved mechanism the contact-jaws will be brought from a position properly removed from the guide-rails for the ordinary operation of the car into close proximity with them by a positive and comparatively simple mechanical movement without the aid of such uncertain factors as springs, compressed air or electromagnets; and then, by a direct continuation of this movement, will be gradually applied with a force sufficient to automatically stop the car after a relatively brief advance for any load which can be lifted, and that manual control is provided for without interference with the automatic operation.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:—

1. The combination with an elevator-car and a fixed contact member, of a movable contact member carried by the car, an operating member for the car contact member, and means for moving the operating member quickly and then more slowly, to effect engagement of the car contact member and fixed contact member, comprising a normally engaged sleeve and releasing devices therefor, permitting the sleeve to rotate in and move longitudinally with the operating member.

2. The combination with an elevator-car and a fixed contact member, of a movable contact member carried by the car, an operating member for the car contact member, and a longitudinally movable and rotatable actuating member associated with the operating member.

3. The combination with an elevator-car and a fixed contact member, of a movable contact member carried by the car, an operating member for the car contact member, and a longitudinally movable and rotatable actuating member having threaded engagement with the operating member.

4. The combination with an elevator-car and a fixed contact member, of a movable contact member carried by the car, an operating member for the car contact member, a longitudinally movable and rotatable actuating member associated with the operating member, and means for retaining the actuating member against rotation during its longitudinal movement.

5. The combination with an elevator-car and a fixed contact member, of a movable contact member carried by the car, an operating member for the car contact member, a longitudinally movable and rotatable actuating member associated with the operating member, and rotatable means for effecting both the longitudinal and rotatable movements of the actuating member.

6. The combination with an elevator-car and a fixed contact member, of a movable contact member carried by the car, an operating member for the car contact member, a longitudinally movable and rotatable actuating member associated with the operating member, a pawl and coacting projection carried by the operating and actuating members, and means for disengaging the pawl.

7. The combination with an elevator-car and a fixed contact member, of a movable contact member carried by the car, an operating member for the car contact member, a longitudinally movable and rotatable actuating member associated with the operating member and being provided with a projection, and a pawl pivoted upon the operating member and which may engage the actuating member projection.

8. The combination with an elevator-car and a fixed contact member, of a movable contact member carried by the car, a shaft journaled upon the car, an operating member surrounding the shaft and coacting with

the car contact member, an actuating member having threaded engagement with the operating member and being provided with an inclined face, and a member rotatable with the shaft and coacting with the inclined face.

9. The combination with an elevator-car and a fixed contact member, of a movable contact member carried by the car, a shaft journaled upon the car, an operating member surrounding the shaft and coacting with the car contact member, an actuating member having threaded engagement with the operating member and being provided with a cam-face and a stop-face, and a member rotatable with the shaft and coacting with the faces of the actuating member.

10. The combination with an elevator-car and a fixed contact member, of a movable contact member carried by the car, a shaft journaled upon the car, an operating member surrounding the shaft and coacting with the car contact member, an actuating member having threaded engagement with the operating member and being provided with a cam-face and a stop-face and with a projection, a pawl pivoted upon the operating member and which may engage the projection, and a member rotatable with the shaft and coacting with the faces of the actuating member and having a portion for engagement with the pawl.

11. The combination with an elevator-car and a fixed contact member, of a movable contact member carried by the car, a shaft journaled upon the car, an operating member surrounding the shaft and coacting with the car contact member, an actuating member having threaded engagement with the operating member and being provided with an inclined face, a member rotatable with the shaft and coacting with the inclined face, and means for effecting an adjustment of the last-named member upon the shaft.

12. The combination with an elevator-car and a fixed contact member, of levers pivoted upon the car and extending upon opposite sides of the contact member, a shaft extending in proximity with the levers, means for rotating the shaft, an operating member associated with the levers and having a threaded portion, a sleeve surrounding the shaft and being provided with a thread engaging that of the operating member and with contact-faces, and a collar rotatable with the shaft and having an arm coöperating with the sleeve contact-faces.

13. The combination with an elevator-car and a fixed contact member, of levers pivoted upon the car and extending upon opposite sides of the contact member, a shaft extending in proximity with the levers, means for rotating the shaft, an operating member associated with the levers and having a threaded portion, a sleeve surrounding the shaft and being provided with a thread engaging that of the operating member and with cam and stop-faces, and a collar rotatable with the shaft and having an arm coöperating with the sleeve cam and stop-faces.

14. The combination with an elevator-car and a fixed contact member, of levers pivoted upon the car and extending upon opposite sides of the contact member, a shaft extending in proximity with the levers, means for rotating the shaft, an operating member associated with the levers and having a threaded portion, a sleeve surrounding the shaft and being provided with a thread engaging that of the operating member and with contact-faces, a pawl mounted upon the sleeve and which may engage the operating member, and a collar rotatable with the shaft and having an arm coöperating with the sleeve contact-faces, said arm having a projection which may coact with the pawl.

15. The combination with an elevator-car and a fixed contact member, of levers pivoted upon the car and extending upon opposite sides of the contact member, a shaft extending in proximity with the levers, means for rotating the shaft, an operating member associated with the levers and having a threaded portion, a sleeve surrounding the shaft and being provided with a thread engaging that of the operating member and with contact-faces, and a collar rotatable with the shaft and being longitudinally movable thereon and having an arm coöperating with the sleeve contact-faces.

16. The combination with an elevator-car and a fixed contact member, of a movable contact member carried by the car, a shaft journaled upon the car, a tapered drum fixed upon the shaft and operating cables surrounding the drum, and means for moving the car contact member actuated by the shaft at a varying speed, a portion of which variation is secured by the taper of the drum, said means comprising a normally engaged sleeve and releasing devices therefor permitting the sleeve to rotate in and move longitudinally with the operating member.

17. The combination with an elevator-car and a fixed contact member, of levers pivoted upon the car and extending upon opposite sides of the contact member, automatically movable means for operating the levers, a link pivoted to the operating means, and an operating lever fulcrumed upon the car and being connected with the link, the link having a slotted connection with the elements it joins.

18. An elevator car, a clamping device therefor, and a differential screw having a high pitch thread and a low pitch thread for actuating the clamping device.

19. An elevator car, a clamping device

therefor, a high pitch screw and a low pitch screw, said screws arranged to actuate the clamping device.

20. An elevator car, a clamping device therefor, a high pitch screw arranged to move the clamping device quickly and a low pitch screw arranged to tighten the clamping device.

21. In a safety device for elevators, the combination of a car, guides for the car, a clamping device for the car, a high pitch screw arranged to move the clamping device against the guides, and a low pitch screw arranged to tighten the clamping device on the guides.

22. In a safety device for elevators, the combination of a car, guides over which the car is adapted to run, a clamping device on the car, and a differential screw having a high pitch thread and a low pitch thread, said screw arranged to move the clamping device quickly against the guides and then to tighten it on the guides.

23. In a safety device for elevators, the combination of a car, guides over which the car is adapted to run, a clamping device on the car, and a differential screw having a high pitch screw and a low pitch screw, said screw arranged to move the clamping device quickly against the guides and then to tighten it on the guides more slowly and with greater force.

24. In a safety device for elevators, the combination of a car, guides over which the car is adapted to run, a clamping device on the car, a high pitch screw arranged to move the clamping device against the guides, a low pitch screw arranged to tighten the clamping device on the guides, and means for actuating the screws.

25. In a safety device for elevators the combination of a car, guides over which the car is adapted to run, a clamping device on the car, a high pitch screw arranged to move the clamping device against the guides, a low pitch screw arranged to tighten the clamping device on the guides, and means for actuating the screws by the motion of the car.

26. In a safety device for elevators, the combination of a car, guides over which the car is adapted to run, a clamping device on the car, a high pitch screw arranged to move the clamping device against the guides, a low pitch screw arranged to tighten the clamping device on the guides, means for actuating the screws by the motion of the car, and additional means for actuating the screws by hand.

27. In a safety device for elevators, the combination of a car, guides over which the car is adapted to run, a clamping device on the car, a high pitch screw arranged to move the clamping device against the guides, a low pitch screw arranged to tighten the clamping device on the guides, and means for actuating the screws by the motion of the car when the car speed reaches a predetermined limit.

28. The combination with an elevator car, guides over which the car is adapted to move, a clamping device on the car, a high pitch screw arranged to move the clamping device against the guides, a low pitch screw arranged to tighten the clamping device on the guides, and a governor connected to be run by the car and arranged to actuate the screws when the speed of the car reaches a predetermined limit.

29. In an elevator safety device, the combination of a car, guides therefor, clamping devices adapted to engage with the guides, right and left hand differential screws each having a high pitch thread and a low pitch thread, arranged to operate the clamping devices.

30. In an elevator safety device, the combination of a car, guides therefor, clamping devices adapted to engage with the guides, right and left hand differential screws each having a high pitch thread and a low pitch thread, arranged to move the clamping devices quickly against the guides and to tighten the clamping devices on the guides.

31. In an elevator safety device, the combination of a car, guides therefor, clamping devices adapted to engage the guides, right and left hand screws arranged to move the clamping devices quickly against the guides, and right and left hand screws of low pitch arranged to tighten the clamping devices on the guides.

32. In an elevator safety device, the combination of a car, guides therefor, clamping devices adapted to engage the guides, right and left hand screws arranged to move the clamping devices quickly against the guides, right and left hand screws of low pitch arranged to tighten the clamping devices on the guides, and means for actuating the screws.

33. In an elevator safety device, the combination of a car, guides therefor, clamping devices adapted to engage the guides, right and left hand screws arranged to move the clamping devices quickly against the guides, right and left hand screws of low pitch arranged to tighten the clamping devices on the guides, and a governor arranged to actuate the screws when the speed of the car reaches a predetermined limit.

34. In an elevator safety device, the combination of a car, guides therefor, clamping devices adapted to engage the guides, right and left hand screws arranged to move the clamping devices quickly against the guides, right and left hand screws of low pitch arranged to tighten the clamping devices on the guides, a governor arranged to actuate the screws when the speed of the car reaches a predetermined limit, and means for actuating the screws by hand.

35. In an elevator safety device, the combination of a car, guides therefor, clamping devices adapted to engage the guides, right and left hand screws arranged to move the clamping devices quickly against the guides, right and left hand screws of low pitch arranged to tighten the clamping devices on the guides, and means for actuating the screws by the movement of the car.

36. In an elevator safety device, the combination with hoistway rails, of friction members adapted to engage said rails, a shaft having portions provided with threads of the same kind or direction but of different pitch, means connecting said threaded portions to said friction members, and means for automatically rotating the shaft.

37. In a safety device for elevators, the combination with hoistway rails, of friction members adapted to engage said rails, a shaft having differentially threaded portions, means connecting said threaded portions to the said friction members, and means for automatically rotating the shaft.

38. In an elevator safety device, hoistway rails, friction members adapted to engage said rails, and a differential screw to operate said members.

39. In an elevator safety device, hoistway rails, gripping jaws adapted to bite against opposite sides of said rails, and a differential screw for operating said jaws.

40. In an elevator safety device, rigid rails for the hoistway, gripping jaws adapted to be mounted on a car and engage said rails, and a differential screw to operate said jaws.

41. In a safety device for elevators, the combination with hoistway rails, of gripping jaws adapted to engage said rails, a differential screw to operate said gripping jaws, and means for automatically operating said screw.

42. In a safety device for elevators, a brake to stop the car, longitudinally operating means for operating the brake, and positive means for actuating said longitudinally operating means at different speeds to first cause the brake to operate quickly and then slower and more powerfully.

43. In a safety device for elevators, a brake, a longitudinally operating member to operate said brake, a drum, and positive means actuated by the drum to first give the brake actuating member a quick initial movement and then a slower and more powerful movement to stop the car.

44. In a safety device for elevators, a brake to stop the car, longitudinally operating means for operating the brake, means for actuating said longitudinally operating means at different speeds to first cause the brake to operate quickly and then slower and more powerfully, and a drum, said actuating means being controlled by the drum.

45. In a safety device for elevators, a brake to stop the car, means for operating the brake, means for automatically actuating said means at different speeds to first cause the brake to operate quickly and then slower and more powerfully, and means for actuating the brake by hand.

46. In a safety device for elevators, a brake, a member to operate said brake, a drum, means actuated by the drum to first give the actuating member a quick initial movement and then a slower and more powerful movement to stop the car, and means for operating the actuating member by hand.

47. In a safety device for elevators, the combination of a brake, a brake actuating member, rotatable means to actuate the brake actuating member, said rotatable means being adapted to first give a quick initial movement to the brake actuating member and then a slower and more powerful movement.

48. In a safety device for elevators, the combination of a brake, a brake actuating member, rotatable means to actuate the brake actuating member, said rotatable means being adapted to first give a quick initial movement to the brake actuating member and then a slower and more powerful movement, and means for operating the brake by hand.

49. In a safety device for elevators, a braking device therefor, and rotatable means having different surfaces for actuating the braking device, one surface being adapted to give a quick initial movement to the braking device and another surface being adapted to give a slower and more powerful movement to the braking device.

50. In a safety device for elevators, a braking device therefor, rotatable means having different surfaces for actuating the braking device, one surface being adapted to give a quick initial movement to the braking device and another surface being adapted to give a slower and more powerful movement to the braking device, and means for automatically actuating the braking device.

51. In a safety device for elevators, a braking device therefor, rotatable means having different surfaces for actuating the braking device, one surface being adapted to give a quick initial movement to the braking device and another surface being adapted to give a slower and more powerful movement to the braking device and means for operating the braking device by hand.

52. In a safety device for elevators, a braking device therefor, rotatable means having different surfaces for actuating the braking device one surface being adapted to give a quick initial movement to the braking device and another surface being adapted to give a slower and more powerful movement to the braking device, and a drum for controlling the action of the rotatable means.

53. In a safety device for elevators, the combination of a car, guides for the car, a clamping device for the car, rotatable means for positively moving the clamping device quickly to the guides, and additional rotatable means for tightening the clamping device on the guides.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

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SAFETY MECHANISM FOR ELEVATORS.

APPLICATION FILED NOV. 27, 1908.

921,432.

Patented May 11, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

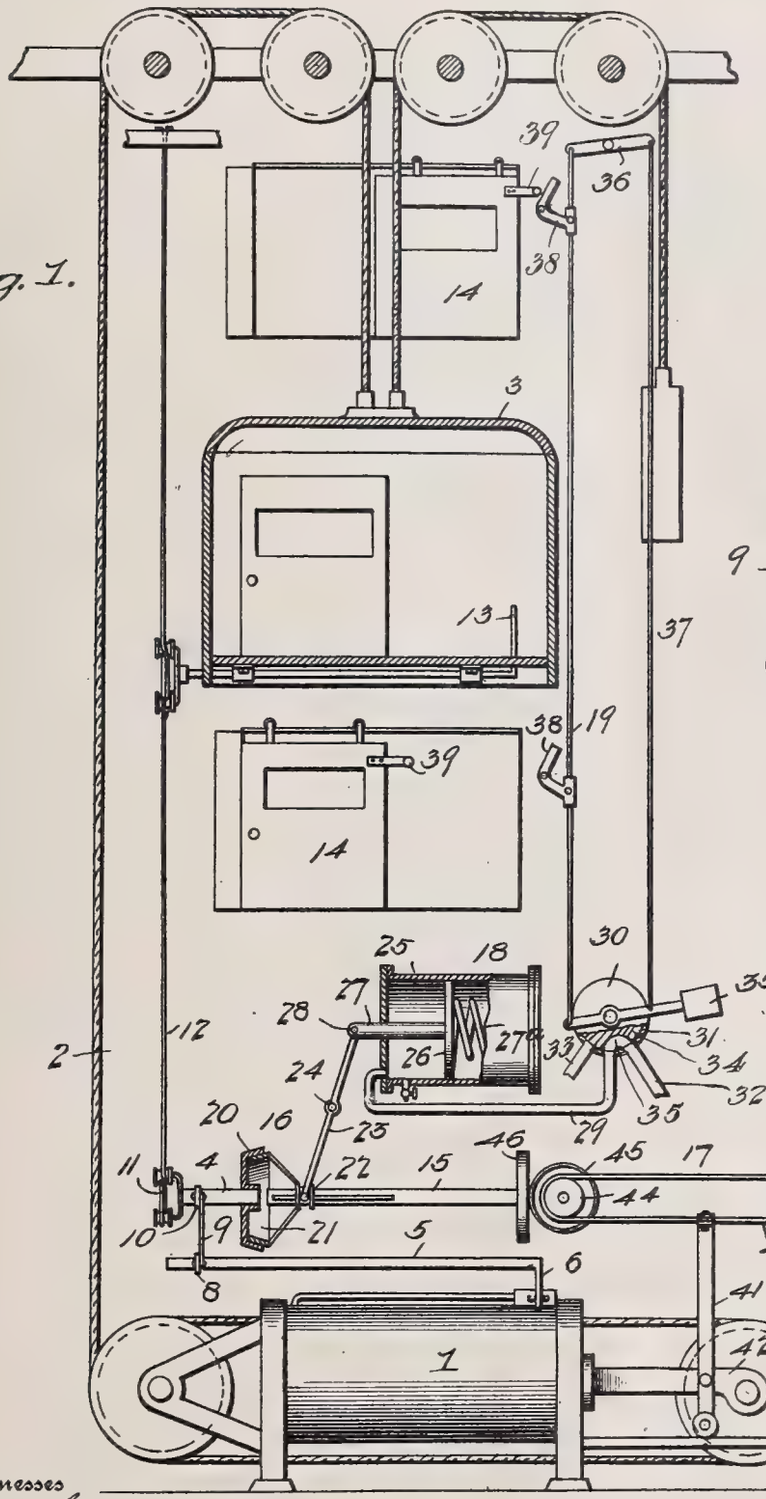
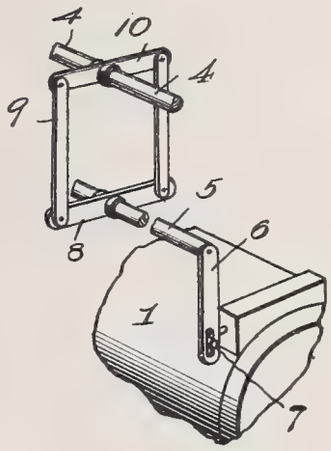


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

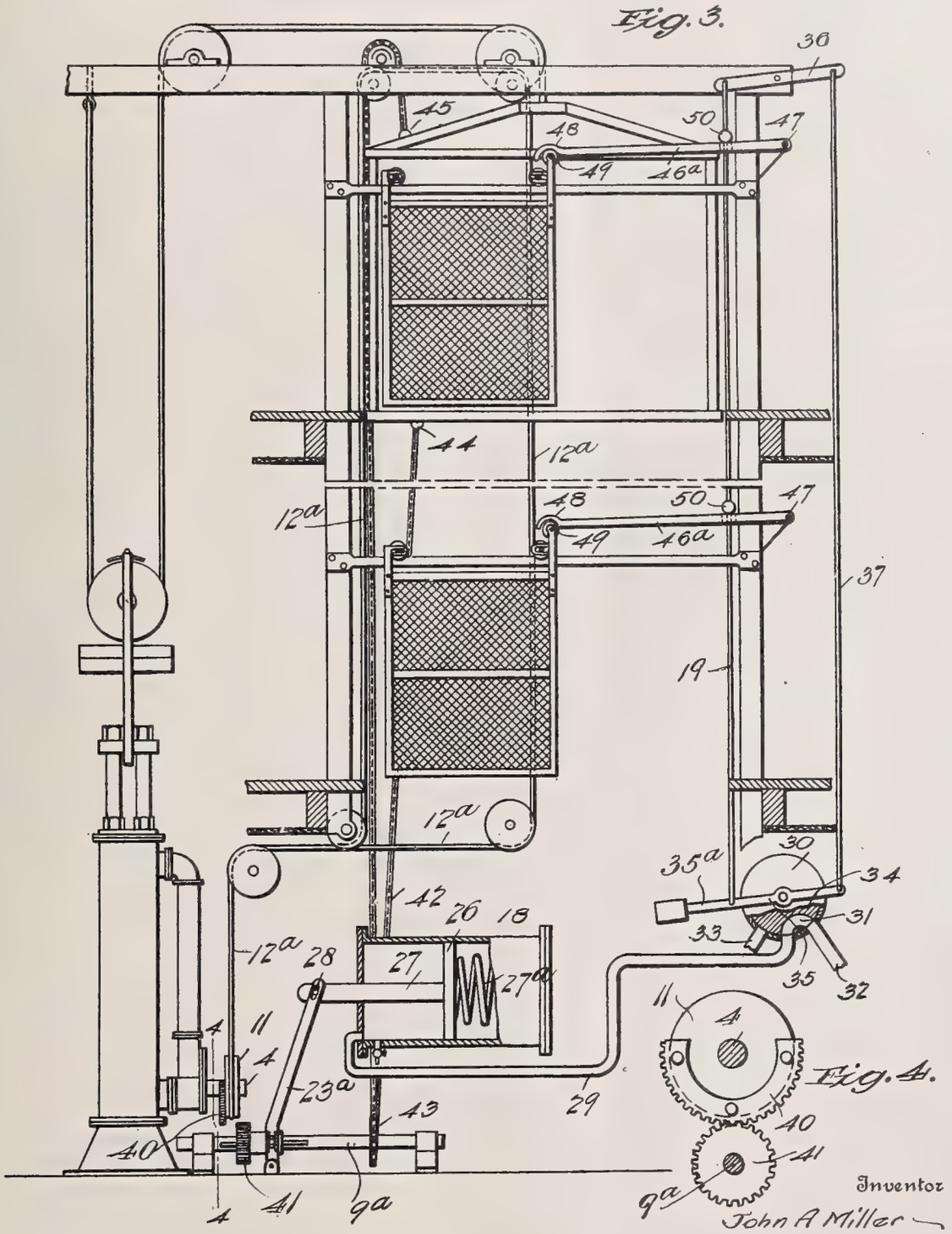

Fig. 4.

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UNITED STATES PATENT OFFICE.

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SAFETY MECHANISM FOR ELEVATORS.

No. 921,432. Specification of Letters Patent. Patented May 11, 1909.

Application filed November 27, 1908. Serial No. 464,538.

To all whom it may concern:

Be it known that I, JOHN A. MILLER, a citizen of the United States, residing at Baltimore, in the county of Baltimore City and State of Maryland, have invented certain new and useful Improvements in Safety Mechanism for Elevators, of which the following is a specification.

This invention relates to safety mechanism for elevators, and has particularly in view a mechanically operated mechanism of this character which becomes operative and effective through the opening of the elevator or landing door, and acts in the dual capacity of a safety lock to lock the elevator against the control of the operator while the door is open, and also as a means for automatically correcting creeping of the car due to leakage in the apparatus. In this connection, the improved safety mechanism is of special utility in its application to hydraulic elevators and embodies the novel idea of providing means for both closing and opening the main control valve of the apparatus upon the opening of the door in order to accomplish the two functions above indicated.

A further and practical object of the invention is to operate the safety mechanism in connection with a mechanical fluid pressure clutch controller.

With these and many other objects in view, which will readily appear to those familiar with the art, the invention consists in the novel construction, combination and arrangement of parts hereinafter more fully described, illustrated and claimed.

The essential features of the invention are necessarily susceptible to a wide range of structural modification, but for illustrative purposes, certain preferred practical embodiments are shown in the accompanying drawings, in which:

Figure 1 is a sectional diagrammatic elevation showing a general view of a hydraulic elevator system equipped with a mechanically operated safety mechanism embodying the combination of features contemplated by the present invention; the view showing one of the elevator or landing doors open, and hence illustrating the various parts of the safety mechanism set to operative position. Fig. 2 is a detail perspective view showing a form of operating connection for the main controlling valve of the motor. Fig. 3 is a sectional diagrammatic elevation showing a general view of another form of hydraulic elevator system equipped with the present invention, and also illustrating another form of clutch connection that may be utilized to connect the safety mechanism with the power control shaft of the elevator motor. Fig. 4 is an enlarged detail sectional view on the line 4—4 of Fig. 3 illustrating more plainly the form of clutch shown in Fig. 3.

Like references designate corresponding parts in the several figures of the drawings.

The improved safety mechanism claimed herein may be installed with various types of motors or lifting apparatus for elevators without material change or modification of such apparatus, so for illustrative purposes, there is shown in Fig. 1 of the drawings a general diagrammatic view of a hydraulic elevator system including a well known form of horizontally arranged hydraulic motor 1 having the usual lift or cable connection 2 with the elevator car 3. The motor equipment includes as one of the working parts thereof a power control shaft 4 having a suitable operating connection with the usual main controlling valve (not shown) subserving the ordinary functions to provide for controlling the flow and exhaust of fluid in the motor cylinder. Any suitable operating connection may be provided between the power control shaft 4 and the motor controlling valve, but the connection shown in Figs. 1 and 2 is illustrated as consisting of a rocker shaft 5 carrying a valve operating arm 6 connected with the stem 7 of the valve, said shaft 5 also carrying an oscillating cross arm 8 having terminal link connections 9 with a similar cross arm 10 on the power control shaft 4, thus providing an arrangement wherein the rocker shaft 5 acts in synchronism with the power control shaft 4 and responds to and follows the exact movements of the latter.

The power control shaft 4 of the motor equipment is fitted with the usual turning element 11 consisting of a wheel or equivalent member which is engaged by the cable 12 operatively associated with the operator's controlling element 13 in the elevator car, said cable constituting a part of said operator's controlling element which is manipulated by the operator in the car to provide for turning the power control shaft 4 in either direction, according to the direction of travel intended for the car in the elevator shaft.

The foregoing elements constitute the usual and well known parts of a common form of hydraulic elevator apparatus, but it is to be understood that the invention is applicable to any form of elevator apparatus having a power control member which provides for cutting off and controlling the power for the motor. However, in the construction shown, it is the purpose of the present invention to combine with such construction an auxiliary mechanism, herein termed the safety mechanism, and which, in turn, is controlled from the car or other moving part of the apparatus whose movement corresponds to the motion of the car, and also controlled by the opening and closing of the doors or gates 14 of the door openings of the elevator shaft. In this connection, it is to be understood that in using the term "elevator door" herein, the same is intended to include any door either off or on the car which is utilized to cover and uncover the door openings at the landings or utilized to protect such door openings, and it is also to be understood that the term "moving part of the apparatus" as above referred to, and as occurring in the claims, is separate and distinct from and does not include the elevator doors.

Referring particularly to the improved safety mechanism, the same essentially comprises an auxiliary control shaft 15, a clutch 16 for coupling the auxiliary shaft to the power control shaft, an operating connection 17 for communicating motion to the auxiliary control shaft 15, and a safety controlling device consisting of a fluid pressure actuator 18 and a safety draw connection 19, said safety controlling device being controlled through the opening and closing of the elevator doors 14, and in turn itself controlling (through the fluid pressure actuator 18) the clutch 16 between the two shaft sections 4 and 15.

The clutch 16 may be of any construction and type suitable for the purpose. For instance, as shown in Figs. 1 and 2 of the drawings, this clutch may be of the friction type of clutch embodying as principal elements thereof a cupped friction disk member 20 made fast to the power control shaft 4, and a friction shoe member 21 operating within and against the disk member 20 and having a sleeve element 22 rigid therewith. The sleeve element 22 of the movable clutch member 21 is intended to freely slide upon the auxiliary control shaft 15, and, for that purpose, has a feathered connection with such shaft. Furthermore, the said shiftable or sleeve element 22 of the clutch member 21 is designed to have suitably connected therewith the pivotal shift lever 23. This lever has a suitable point of pivotal support 24, and is controlled in its movements directly from the fluid pressure actuator 18. This actuator consists of a hydraulic or equivalent cylinder 25, a piston 26 movable therein, and an auxiliary actuating spring 27^a interposed between the piston 26 and one end of the cylinder. The piston rod 27 extends without the cylinder 25 and has a pivotal connection 28 with one end of the shift lever 23. The water or other operating fluid is conducted to and exhausted from the hydraulic cylinder 25 through a fluid circulating pipe 29 having a connection with one of the ports in the casing of a three-way or equivalent venting valve 30. Any kind of three-way or equivalent venting valve may be employed in this connection, but for the purposes of this case, the valve illustrated simply consists of a casing 31 having ports with which are connected the pipe 29 and fluid supply and exhaust pipes 32 and 33 respectively. With these several ports coöperates the oscillating valve plug 34 having a two-way port 35 therein which is designed to respectively connect the pipes 29 and 32, and 29 and 33, according to whether the safety mechanism is in operative or inoperative condition. The stem of the valve 34 has suitably fitted thereto a rocking weight lever 35^a which is weighted at one end and has connected thereto one end of the safety draw connection 19, the other end of which safety draw connection is suitably connected to a rocking hanger lever 36 located at the top of the elevator shaft and providing for properly hanging or stringing the cable or connection 19 in place. To provide for permitting the necessary up and down movement for the cable or connection 19, there is also associated with the levers 35 and 36 a balancing cable 37 which is arranged on the opposite side of the pivots for the levers 35 and 36 from the said cable or connection 19.

In the embodiment of the invention suggested in Fig. 1 of the drawings, the cable or safety draw connection 19 has suitably connected thereto, at points in the path of movement of the elevator door 14, bell crank or equivalent release levers 38 adapted to be engaged by the tappet or strike projections 39 on the elevator doors 14.

The operating connection 17 above referred to may be conveniently in the form of an endless belt or cable 40 having a fast connection 41 with a movable part 42 of the elevator motor 1, and arranged to pass over oppositely located belt wheels 43 and 44, the latter of which communicates its motion to a shaft carrying a friction wheel 45 contacting with and driving a friction disk 46 carried by the auxiliary control shaft 15.

Referring to the operation of the mechanism as illustrated in Figs. 1 and 2 of the drawings, it will be observed that when all of the doors 14 are closed, the weighted end of the lever 35^a holds the valve 34 in position for connecting the pipe 29 with the exhaust 33, thus cutting off the fluid pres-

sure supply for the hydraulic cylinder and permitting the spring 27ª of the actuator 18 to draw back the clutch member 21 out of engagement with the clutch member 20 so as to hold the clutch 16 open, thus permitting the usual control of the apparatus through the operator's controlling element 12 and 13. However, when a car stops at a landing and a door 14 is thrown open as shown at the top of Fig. 1 of the drawings, the tappet 39 of such door engages the release lever 38 in the path thereof with the result of rocking said lever so as to move the safety draw connection 19 downward and cause a turning of the valve 34 to establish communication between the pipes 32 and 29, whereupon the water or other fluid under pressure passes into the cylinder 25 and moves the piston 26 against the tension of the spring 27ª, thereby rocking the shift lever 23 in a direction for throwing the clutch 16 into action and coupling the shaft sections 4 and 15. Now, inasmuch as the operating connection 17 is arranged to move exactly the reverse of the movement provided for by the operator's controlling element 12, 13, it is apparent that as long as a door is open, the elevator apparatus is effectually locked against the control or manipulation of the operator. However, in the event of the elevator creeping after being stopped by the operator and the door being open, the creeping movement is transmitted to the connection 17, from the latter to the friction disk 46, to the auxiliary shaft 15, and through the clutch 16 to the power control shaft 4, with the result of automatically moving the main power control valve of the motor in a direction for correcting the said creeping movement, and automatically restoring the equilibrium of the parts without regard to the leakage.

In further explanation of the operation of that form of the mechanism illustrated in Figs. 1 and 2 of the drawings, it may be observed that according to the construction shown in these figures of the drawings, the shaft doors 14 must be opened fully before the tappet or strike projections 39 thereon engage the release levers 38, but it is of course understood that the invention comprehends either an arrangement of this character or one wherein the safety mechanism is set into operative condition and action immediately upon the unlatching of the shaft doors, and hence at the very moment when the operator starts the opening thereof. This is fully contemplated by the form of the invention shown in Fig. 3 of the drawings hereinafter more fully explained, but in further relation to the form shown in Fig. 1 of the drawings, it is also to be understood that the shaft doors 14 are sufficiently heavy to remain stationary in their extreme fully opened positions against the pressure of the much lighter weight 35ª. Furthermore, in any and all embodiments of the invention it is to be understood that the elevator door 14 is one of the operating elements of the mechanism, and the parts controlling the draw connection 19 are operated from the door, that is, by the door.

To exemplify the range of modification that may be resorted to in carrying out the invention, there is shown in Fig. 3 of the drawings, a general view of another form of hydraulic elevator system equipped with the improved safety mechanism. In this embodiment there is illustrated an elevator motor or lifting apparatus of the vertical type and the power control shaft 4 of which has the turning element 11 in the form of the usual wheel around which passes the cable 12ª which extends through and into the elevator car and constitutes the operator's controlling element in a manner well known to those familiar with the art. Also, in said Fig. 3 of the drawings, there is suggested a form of clutch illustrating the wide range of structures that may be utilized in carrying forward the invention, that is clutches of different kinds for coupling shaft sections in axial alinement, as well as clutches for connecting shaft sections out of alinement or in parallel, which latter arrangement is shown in Figs. 3 and 4 of the drawings. In these figures of the drawings, the clutch shown comprises the shaft section 4 having a gear segment 40 which is preferably fastened to the turning element or wheel 11 and which is adapted to mesh with a shiftable clutching gear 41 feathered on the auxiliary control shaft section 9ª. The shiftable clutching gear 41 is designed to have operatively connected therewith the shift lever 23ª or equivalent shifting means. Furthermore, in this form of the invention, viz: the one illustrated in Figs. 3 and 4, the operating connection for communicating motion to the auxiliary control shaft 9ª may be conveniently in the form of a sprocket chain or other form of cable 42 arranged to pass over a wheel 43 on the auxiliary shaft 9ª and having its opposite terminals as at 44 and 45, respectively connected to opposite parts of the car so that when the car is traveling in one direction, the cable or connection 42 is moved one way, and vice versa.

A still further modification suggested in Fig. 3 of the drawings, is that of normally having the parts (when the doors are closed) in such position that the pipes 29 and 32 are in communication and the pressure of the fluid exerted in a direction on the piston 26 so as to hold the clutch 41 open, thereby providing an arrangement wherein, when the valve 34 is turned by the opening of a door, the spring 27ª comes into play for closing the clutch by shifting the gear 41 into engagement with the gear 40, through the move-

ment of the lever 23[a]. Also, in the form of the invention shown in Fig. 3, there is suggested the idea of associating with each door a release lever 46[a] having a fixed point of pivotal support at one end as at 47, and at its other end provided with a drop off keeper 48, which, under normal conditions with the door closed, receives a bearing or contact wheel 49 carried by the elevator door. Each release lever 46[a] is arranged to bear under and against a stop projection or button 50 on the cable 19 constituting the safety draw connection. When a door is drawn open, the wheel 49 passes out of the drop off keeper 48 and rides on the straight portion of the lever 46[a], but this action is sufficient to lift the lever with the result of drawing upward on the cable 19 and turning the valve 34 to establish communication between the pipes 29 and 33, so that the fluid may exhaust from the cylinder and the spring 27[a] come into play to close the clutch. In connection with this operation it will be observed that the weight for the lever 35[a] is reversed in position from that shown in Fig. 1.

By way of illustration, two types of clutches are shown in the drawings and described herein, but it is to be understood that any form of clutch capable of performing the functions described may be utilized, irrespective of whether said clutch is designed to operate in conjunction with two shaft sections or only with a single shaft section, as it is only necessary for this part of the invention to employ a normally open clutch having a member turning with the power control shaft, and a normally idle member which is partly controlled from the elevator door, and also rotated from the car or other moving part of the apparatus. It will also be noted in this connection that the clutch, in whatever form used, acts in the capacity of a driving gear and consequently the present invention contemplates any form of gear connection between the two shaft sections which will perform the functions of the clutches herein described.

I claim:

1. In a safety mechanism for elevators, the combination with the power control shaft, of a normally open clutch having a member turning with said shaft and also having a normally idle member, means for transmitting motion to said normally idle member of the clutch from a moving part of the apparatus, and mechanical means for controlling the opening and closing of the clutch through the opening and closing of the elevator door.

2. In a safety mechanism for elevators, the combination with the power control shaft, of an auxiliary control shaft, a normally open clutch connection between said two shafts, means for transmitting motion to the auxiliary shaft from a moving part of the apparatus, and mechanical means for controlling the opening and closing of the clutch through the opening and closing of the elevator door.

3. In a safety mechanism for elevators, the combination with the power control shaft and the operator's controlling element, of an auxiliary control shaft, a normally inoperative clutch connection between said two shafts, means for transmitting to the auxiliary shaft a motion reverse and in opposition to that transmitted to the power control shaft from the operator's controlling element, and means for mechanically controlling the opening and closing of the clutch by the opening and closing of the elevator door.

4. In a safety mechanism for elevators, the combination with the power control shaft and the operator's controlling element, of an auxiliary control shaft, a normally inoperative clutch connection between said two shafts, means for transmitting to the auxiliary shaft a motion reverse to that transmitted to the power control shaft from the operator's controlling element, and a door controlled actuator having means for mechanically controlling the opening and closing of the clutch through the opening and closing of the elevator door.

5. In a safety mechanism for elevators, the combination with the power control shaft, of a normally open clutch having a member turning with said shaft and also having a normally idle member, means for transmitting motion to said normally idle member of the clutch from a moving part of the apparatus, and a door controlled actuator having means for mechanically controlling the opening and closing of the clutch through the opening and closing of the elevator door.

6. In a safety mechanism for elevators, the combination with the power control element, of a normally open clutch having one member connected with said power control element and also having a normally idle member, means for transmitting motion to said normally idle member of the clutch from a moving part of the apparatus, and a mechanical actuator for said clutch having means for controlling the opening and closing of the clutch from the elevator door.

7. In a safety mechanism for elevators, the combination with the power control element, of a normally open clutch having one member connected with said power control element and also having a normally idle member, means for transmitting motion to the normally idle clutch member from a moving part of the apparatus, and a fluid pressure actuator for opening and closing said clutch.

8. In a safety mechanism for elevators, the combination with the power control element,

of a shaft-turning clutch having one member connected with the power control element, means for transmitting motion to the other clutch member from a moving part of the apparatus, and a mechanically operated door controlled actuator for opening and closing said clutch.

9. In a safety mechanism for elevators, the combination with the power control element of a shaft-turning clutch having one member connected with the power control element, means for transmitting motion to the other clutch member from moving a part of the apparatus, and a door controlled fluid pressure actuator for opening and closing said clutch.

10. In a safety mechanism for elevators, the combination with the power control element, of a shaft-turning clutch having one member connected with the power control element, means for transmitting motion to the other clutch member from a moving part of the apparatus, and a safety controlling device consisting of a fluid pressure actuator and a safety connection operatively related to the said actuator and to the elevator doors, said safety controlling device comprising means for opening and closing the clutch.

11. In a safety mechanism for elevators, the combination with the car, the shaft, the doors and power control element, of a mechanism including a clutch for locking and actuating said element, and mechanical means for setting said mechanism into operative condition from any door with the elevator car at any point within the shaft.

12. In a safety mechanism for elevators, the combination with the elevator doors, the power control element and the operator's controlling element, of a mechanism, independent of the operator's controlling element, and including a clutch for locking and actuating said power control element, and mechanical means for controlling said mechanism from the elevator doors.

13. The combination with the elevator motor, its operating mechanism, the car, the operator's controlling element, and a door; of means including a clutch independent of the operator's controlling element for locking said motor operating mechanism against manipulation by the operator and for operating the said motor operating mechanism for both stopping and starting, and mechanical means actuated by the said door for operating said first-mentioned means.

14. In a safety mechanism for elevators, the combination with the power control element, and the operator's controlling element, of a mechanism independent of said operator's controlling element and comprising means for locking the power control element against the control of the operator, and for actuating the same for both stopping and starting, and a door-controlled fluid pressure actuator for controlling said mechanism from the elevator doors.

15. In a safety mechanism for elevators, the combination with the elevator doors, the motor, the power control element, and the operator's controlling element, of a safety mechanism independent of said operator's controlling element and comprising mechanical means for automatically operating said power control element to both stop the motor and permit the starting thereof upon the opening of an elevator door.

16. In a safety mechanism for elevators, the combination with the elevator doors, the motor, the power control means therefor, and the operator's controlling element; of a safety mechanism independent of said operator's controlling element and comprising mechanical means for automatically locking said power control means against manipulation by the operator, and also for automatically operating said power control means to both stop the motor and permit the starting thereof upon the opening of an elevator door.

17. In a safety mechanism for elevators, the combination with the power control element, of a mechanism including a clutch for locking said element against the control of the operator and for turning the same, a fluid pressure actuator for throwing said mechanism in and out of action, and a door controlled device for controlling the operation of said actuator.

18. In a safety mechanism for elevators, the combination with the power control element, of a clutch having one member connected with the power control element, means for transmitting motion to the other clutch member from a moving part of the apparatus, and a safety controlling device consisting of a fluid pressure actuator comprising a hydraulic cylinder, a piston in the cylinder operatively connected with the shiftable clutch member and a spring arranged at one side of the piston, a venting valve, a fluid circulating pipe connection between said valve and the cylinder, and a safety draw connection operatively related to said valve and to the elevator doors.

19. In a safety mechanism for elevators, the combination with the power control element, of a clutch having one member connected with the power control element, means for transmitting motion to the other clutch member from a moving part of the apparatus, a fluid pressure actuator comprising a cylinder, a piston, and a spring arranged to move the piston in one direction, said piston being operatively connected with the shiftable clutch member, a venting valve, a fluid circulating pipe connection between said valve and the cylinder, a weighted safety draw connection operatively connected with the valve for turning the same

in both directions, a contact element carried by each elevator door, and a swinging release lever associated with each door, each release lever having a pivotal support at one end and a drop off keeper at its opposite end.

20. In a safety mechanism for elevators, the combination with the elevator car, a shaft door, mechanism for operating the car, and a controlling mechanism including a gear; an auxiliary shaft, a gear carried by the auxiliary shaft and movable into and out of mesh with said other gear, means for transmitting motion to the auxiliary shaft from a moving part of the apparatus, and means governed by the door for automatically connecting and disconnecting said gears.

21. In a safety mechanism for elevators, the combination with the motor the power control means therefor and the operator's controlling element of mechanism independent of the operator's controlling element and comprising means for automatically locking said power control means against manipulation by the operator, and also for automatically operating said power control means to both stop the motor and permit the starting thereof, and mechanical means operating when the elevator door is put in unsafe or insecure position to throw said mechanism into operation.

22. The combination with an elevator motor and its operating mechanism, the car, the operator's cable and a door, of mechanical means, independent of the operator's cable, for controlling the motor operating mechanism of said car for both stopping and starting by the opening of said door.

23. The combination with an elevator motor and its operating mechanism, the car, the operator's cable and a door, of fluid pressure means, independent of the operator's cable, for controlling the motor operating mechanism of said car for both stopping and starting by the opening and closing of said door.

24. In a safety mechanism for elevators, the combination with the motor and its power control element and the operator's cable, of means including a lever, independent of the operator's cable, for locking the said power control element against manipulation by the operator, and also for operating the said power control element for both stopping and starting the motor, yieldingly-acting means for controlling the movement of said lever in one direction, a door, and mechanical means governed from said door for controlling the movement of said lever in the other direction.

25. In an elevator, the combination with the elevator car, the operator's cable the motor, and its power control element, of a mechanism comprising means, independent of the operator's cable, for operating the said power control element for both stopping and starting the motor, a door, and a fluid pressure actuator for controlling the said mechanism by the opening and closing of said door.

26. In an elevator, the combination with the elevator car, the operator's cable the motor, and its power control element, of a mechanism comprising means, independent of the operator's control cable, for operating the said power control element for both stopping and starting the motor, a door, and mechanical means operated from said door for controlling the said mechanism.

27. In an elevator, the combination with the elevator car, the operator's cable, the motor, and its power control element, of mechanical means including a lever, independent of the operator's controlling cable, for operating the said power control element for both stopping and starting the motor, a door, and mechanical means operated from said door for controlling the movements of said lever.

28. In an elevator, the combination with the elevator car, the operator's cable, a door, the motor and its power control element of means including a lever independent of the operator's cable, for locking the said power control element against manipulation by the operator and for operating the said power control element for both stopping and starting the motor, and mechanical means operated from said door for controlling the movements of said lever.

29. In an elevator, the combination with the motor and the power control therefor, of a cylinder and piston therein connecting with the said power control so as to lock the same against manipulation by the operator, means independent of the operator's cable for operating the said power control for both stopping and starting the motor, a valve for said cylinder, and connections between said valve and a door whereby the latter controls the operation of the valve.

30. The combination with an elevator car, an elevator shaft and the doors thereof, mechanism for operating the car and a controlling mechanism therefor, of a normally open clutch having a member operatively connected with the said controlling mechanism, and also having a normally idle member, means for transmitting motion to the normally idle member of the clutch from a moving part of the apparatus, levers adjacent to, and adapted to be operated by, said doors, a draw connection having connection with said levers so as to move upward when any one of said levers is actuated by the door adjacent thereto being put into an unsafe or insecure condition, means independent of said levers for overbalancing said draw connection when the doors are closed,

and means connected with the draw connection for closing the clutch.

31. The combination with an elevator car, an elevator shaft and the doors thereof, mechanism for operating the car and a controlling mechanism therefor, of a normally open clutch having a member operatively connected with the said controlling mechanism, and also having a normally idle member, means for transmitting motion to the normally idle member of the clutch from a moving part of the apparatus, levers adjacent to, and adapted to be operated by, said shaft doors, a draw connection having connection with said levers so as to move upward when any one of the said levers is actuated by the door adjacent thereto being put into an unsafe or insecure condition, means for overbalancing said draw-connection when the doors are closed, and means connected to the draw connection for closing the clutch.

32. The combination with the elevator car, the elevator shaft and the doors thereof, mechanism for operating the car and a controlling mechanism therefor, of a normally open clutch having a member operatively connected with the said controlling mechanism, and also having a normally idle member, means for transmitting motion to the normally idle member of the clutch from a moving part of the apparatus, levers adjacent to, and adapted to be operated by, said shaft doors, a draw connection having connection with the said levers so as to move upward when any one of said levers is actuated by the door adjacent thereto being put into an unsafe or insecure condition, means for overbalancing said draw connection when the doors are closed, and a fluid-pressure actuator connected with the draw connection for opening the clutch.

33. The combination with the elevator car, the elevator shaft and the doors thereof, the motor and its controlling mechanism, of a clutch having one member operatively connected to the said motor controlling mechanism, means for transmitting motion to the other clutch member from a moving part of the elevator apparatus, a draw connection arranged to control the engagement and disengagement of the member of the said clutch, and means operating upon the opening and the closing of the said shaft doors to control the movements of the said draw connection.

34. The combination with the elevator car, the elevator shaft and the doors thereof, the motor and its controlling mechanism, of a clutch having a member operatively connected to the said motor controlling mechanism, means for transmitting motion to the other clutch member from a moving part of the apparatus, a lever operatively connected to the clutch so as to control the engagement and disengagement of the members thereof, and mechanical means operating upon the opening and closing of the said shaft doors to control the movements of the said lever.

35. In a safety mechanism for elevators a plurality of doors, motor controlling means, a clutch having a member operatively connected to the said controlling means, and also having a normally idle member, means for transmitting motion to the normally idle member of the clutch from a moving part of the apparatus, a draw connection, arranged to control the opening and the closing of the clutch, a plurality of stop projections attached to the said draw-connection, and a plurality of door controlled levers connected with the said draw connection so as to engage said stop projections.

36. In a safety mechanism for elevators, the landing door, motor controlling means, a clutch having a member operatively connected to the said motor controlling means, and also having a normally idle member, means for transmitting motion to the said normally idle member of the clutch from a moving part of the apparatus, a yieldingly-acting device causing the members of the clutch to become engaged, operating when the landing door is put into an unsafe or insecure condition, a lever adapted to be operated by said landing door, and connections between said lever and one member of the clutch for causing the disengagement of the said clutch members when the landing door is put into a safe or secure condition.

37. In an elevator, the combination with an elevator car, the elevator shaft and its doors, the motor and its controlling mechanism therefor, of a clutch having one member operatively connected to the said motor controlling mechanism and also having a normally idle member, means for transmitting motion to the normally idle member of the clutch from a moving part of the apparatus, a lever when in one position connected so as to be adapted to cause the disengagement of the clutch members, and means controllable from a shaft door whereby when the said door is put into an unsafe or insecure condition the said lever will be operated to engage the clutch members.

38. In a safety mechanism for elevators, the landing door, motor controlling means, a clutch having a member operatively connected to the said controlling means, and also having a normally idle member, means for transmitting motion to the said normally idle member of the clutch, from a moving part of the apparatus, a yieldingly-acting device for closing said clutch operating when the landing door is put into an unsafe or insecure condition, and mechanical connection between said landing door and the clutch for causing

the disengagement of the members of said clutch, operating when the landing door is put into a secure or safe condition.

39. In a safety mechanism for elevators, the landing door, motor controlling means, a clutch having a member operatively connected with the said controlling means, and also having a normally idle member, means for transmitting motion to the said normally idle member of the clutch from a moving part of the apparatus, a yieldingly-acting device for closing said clutch, operating when the landing door is put into an unsafe or insecure condition, and a fluid-pressure actuator acting upon the clutch for causing disengagement of the members thereof, and connections between said landing door and the fluid-pressure actuator operating when the landing door is put into a secure or safe condition.

40. In an elevator, motor controlling means, a clutch having a member operatively connected with the said motor controlling means, and also having a normally idle member, means for transmitting motion to the normally idle member of the clutch from same moving part of the apparatus, a yieldingly-actuated mechanism operating upon one member of the clutch to effect the closing of the clutch, a landing door, and positively actuated mechanism operated by the closing of the landing door to move said clutch member in the opposite direction to that in which it is moved by said yieldingly-actuated mechanism, substantially as and for the purposes set forth.

41. In a safety mechanism for elevators, motor controlling means, a clutch having a member operatively connected with the said controlling means and also having a normally idle member, means for transmitting motion to the said normally idle member of the clutch from a moving part of the apparatus, a series of landing doors, a series of levers adjacent to and adapted to be operated by said landing doors, and a draw connection operatively related to said levers and to the clutch, said levers engaging said landing doors and the draw connection, substantially as and for the purposes described.

42. In an elevator, the combination of the elevator car, a series of landing doors, a series of levers adjacent said landing doors, and positively operated in one direction by the opening of the said landing doors, means yieldingly operating said levers in the opposite direction, a safety device for the elevator controlling means consisting of a clutch having one member operatively connected to the controlling means of the elevator, and the other a normally idle member, means for transmitting motion to the normally idle member of the clutch from a moving part of the apparatus, and a draw connection connected to each of said levers and with one member of said clutch to effect engagement and disengagement of the members thereof, substantially as and for the purposes set forth.

43. In a safety mechanism for elevators, a motor controlling means, a clutch having one member operatively connected to the said controlling means, and a normally idle member, means for transmitting motion to the normally idle clutch member from a moving part of the apparatus, a pivoted lever, suitably connected with the normally idle clutch member, a safety draw connection connected with the said pivoted lever, so as to keep the members of the clutch disengaged, a counterbalance for said draw connection, a plurality of levers, connections between said levers and said draw connection, and a plurality of sliding doors engaging said levers.

44. In an elevator, the combination of a safety device, consisting of a clutch having one member operatively connected to the motor controlling mechanism of said elevator, and a normally idle member arranged so as to engage the clutch member connected to the motor controlling mechanism, yieldingly-acting mechanism for bringing the two members of the clutch into engagement, a landing door, a lever operated by the movements of the said landing door, and connection between said idle member of the clutch and the lever whereby the members of the clutch will become engaged when the said door is open or put into an unsafe or insecure condition.

45. In a safety mechanism for elevators, a motor controlling means, a clutch having one member operatively connected to the said motor controlling means, and a normally idle member, means for transmitting motion to the normally idle clutch member from a moving part of the apparatus, a lever connected to the normally idle clutch member, landing doors, and mechanical means operated by the opening and closing of the landing doors for controlling the movements of the said lever.

46. In a safety mechanism for elevators, a motor controlling means, a clutch having one member operatively connected to the said motor controlling means, and a normally idle member, means for communicating motion to the normally idle clutch member from a moving part of the apparatus, a lever connected to the said normally idle clutch member, a landing door, and mechanical means operated by the opening and closing of the landing door for moving the lever in one direction when the landing door is open and in the other direction when the landing door is closed.

47. The combination with an elevator car,

an elevator shaft, and the doors thereof, mechanism for operating the car, and a controlling mechanism therefor, of a normally open clutch, having one member operatively connected to the said controlling mechanism, and a normally idle member, means for transmitting motion to the normally idle clutch member from a moving part of the apparatus, a lever adapted to move the said normally idle clutch member in and out of engagement with the clutch member connected to the motor controlling mechanism, yieldingly-acting means for causing the lever to move in one direction, means acting positively upon said lever to move it in the opposite direction, and mechanical means operated by the shaft door for operating the means acting positively upon the said lever.

48. The combination with an elevator car, an elevator shaft and the doors thereof, mechanism for operating the car, and its controlling mechanism, of a normally open clutch having one member operatively connected to the said controlling mechanism and a normally idle member, means for transmitting motion to the normally idle clutch member from a moving part of the apparatus, a spring arranged to yieldingly impel the engagement of the normally idle clutch member with the clutch member that is operatively connected to the said controlling mechanism, and a fulcrumed lever engaging said idle member of the clutch so as to move it out of engagement, and means operated by the said doors for operating the said fulcrumed lever.

49. An elevator controlling means, comprising a door, a car, a motor, the power control element therefor, and mechanical means, actuated by the said door, independent of the operator's control device, for governing the said motor power control element by the said car.

50. The combination with an elevator car, elevator shaft, the doors thereof, the motor, the power control element therefor, of means, independent of the operator's control device, normally unaffecting the power control element, acting to stop the motor and shift the said motor control element to an inoperative condition, and lock the same against manipulation by the operator, connection between a moving part of the apparatus and said means whereby the former actuates the latter, and mechanical means operated by the opening of the said door for rendering the said first mentioned means operative with respect to the motor control element.

51. An elevator controlling means, comprising a door, a car, a motor, the power control element therefor, and mechanical means actuated by the said door, including a clutch, for governing the said motor power control element by the said car said mechanical means being operable from any door with the elevator car at any point within the shaft.

52. An elevator controlling means, comprising the combination with a door, a car, a motor, and the power control element therefor, of a clutch, having a member operatively connected with said car, the other member of the said clutch operatively connected with the said motor power control element and mechanical means, actuated by the said door for causing the engagement and disengagement of the members of the said clutch.

53. The combination with the elevator car, the motor, the power control element therefor, of a mechanism, normally unaffecting the said power control element, comprising means, independent of the operator's control device, for locking the said power control element against manipulation by the operator, and also for operating the said power control element for both stopping and starting the motor, means for operating the said mechanism from a moving part of the apparatus, a door, and mechanical means operated by the said door for rendering said mechanism operative with respect to the motor control element.

54. In a safety mechanism for elevators, the combination with the motor, the power control element therefor, of means, independent of the operator's control device, for locking the said power control element against manipulation by the operator, and also for operating said power control element for both stopping and starting the motor, yieldingly-acting means for controlling the movement of the first mentioned means in one direction, means acting positively upon the said first mentioned means to move it in a direction opposite to that in which it was moved by the said yieldingly-acting means, and mechanical means operated by the shaft door for operating the means acting positively upon the said first mentioned means.

55. In a safety mechanism for elevators, the combination with the power control shaft, of an auxiliary control shaft having a driving wheel, a normally inoperative clutch connection between said two shafts, an operating cable connected with the elevator car and arranged upon the driving wheel reversely to the arrangement of the connection of the operator's controlling element with the power control shaft, and means for mechanically controlling the opening and closing of the clutch through the opening and closing of the elevator door.

56. In a safety mechanism for elevators, the combination with the power control shaft, of an auxiliary control shaft, a normally inoperative clutch connection between said two shafts, means for transmitting to

the auxiliary shaft a motion reverse to that transmitted to the power control shaft from the operator's controlling element, a safety draw connection operatively connected with the clutch for controlling the opening and closing thereof and having stop projections, and a door actuated device having a lever element engaging with a stop projection for moving the draw connection in one direction.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

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J. T. COWLEY.

ELEVATOR.

APPLICATION FILED JULY 17, 1905.

928,364.

Patented July 20, 1909.

5 SHEETS—SHEET 1.

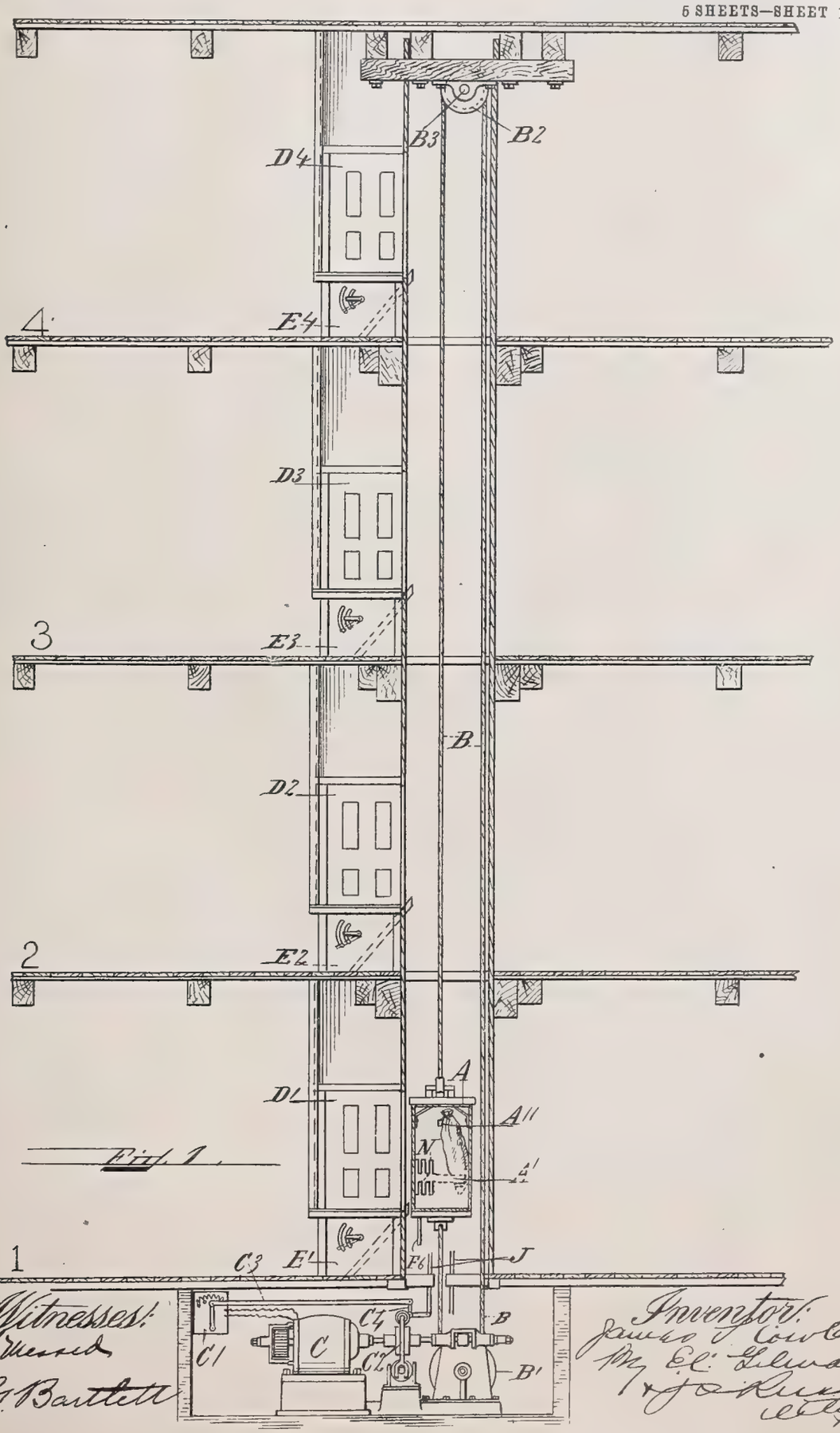

Fig. 1.

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5 SHEETS—SHEET 2

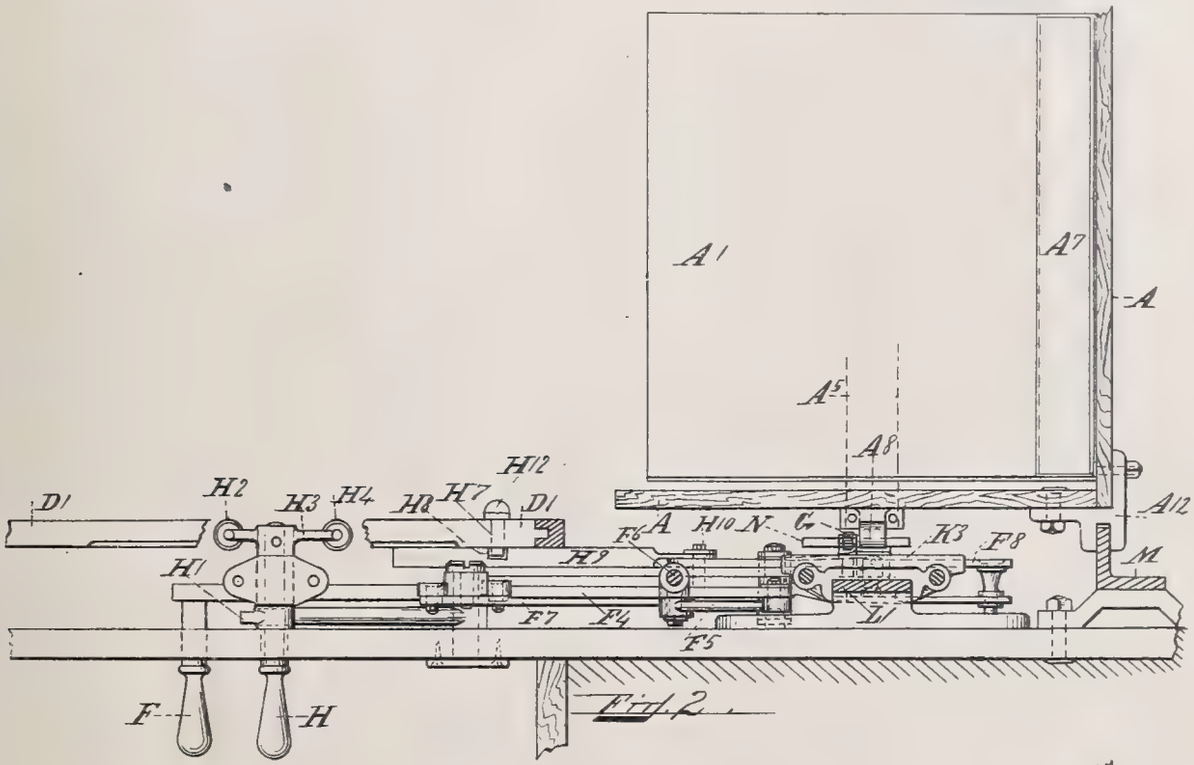

Fig. 2.

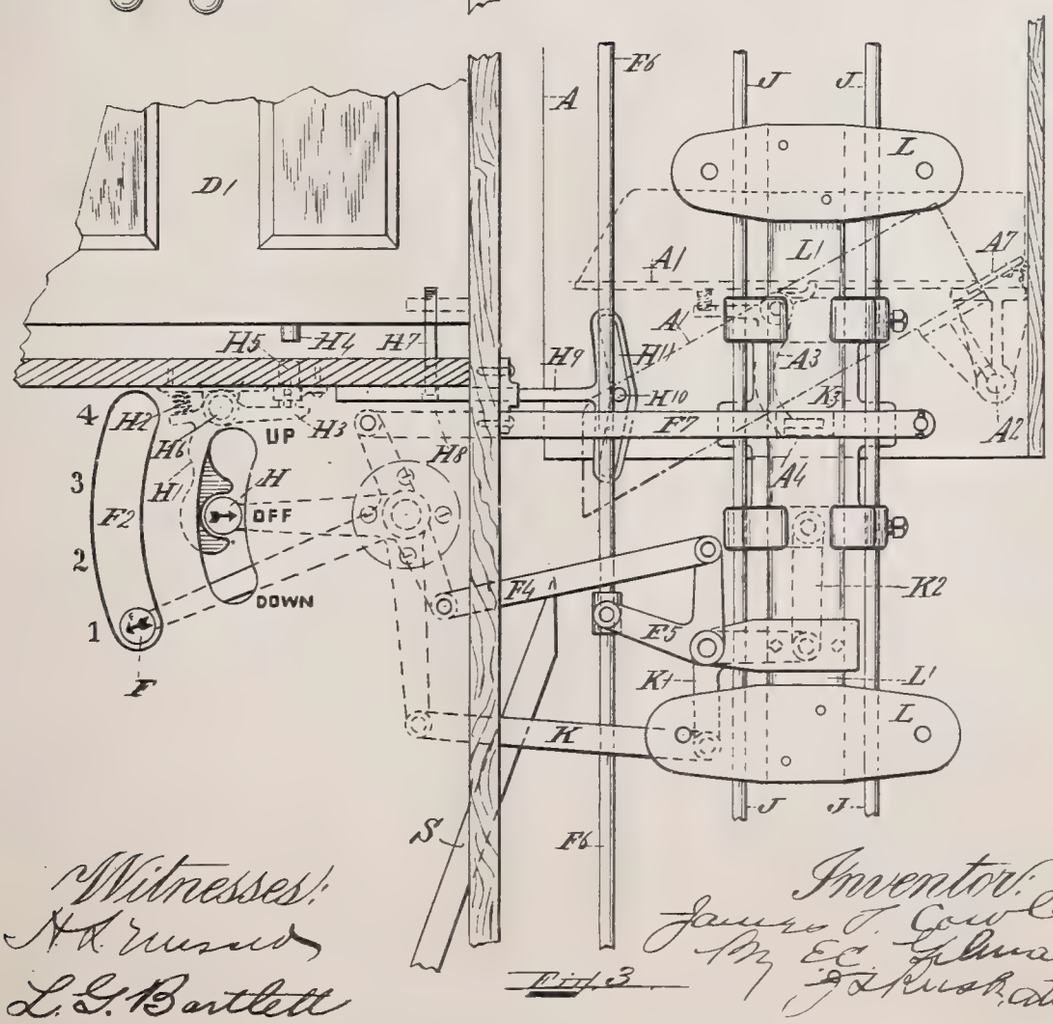

Fig. 3.

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5 SHEETS—SHEET 3.

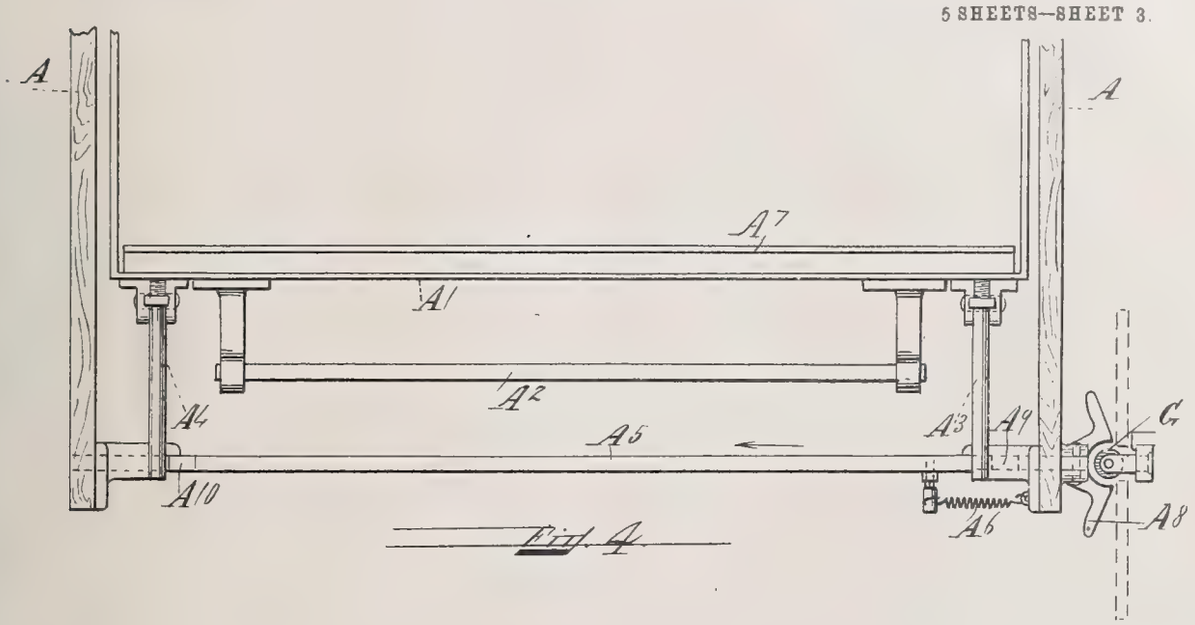

Fig. 4.

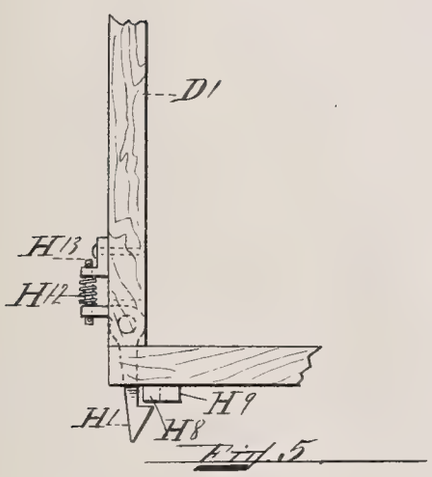

Fig. 5.

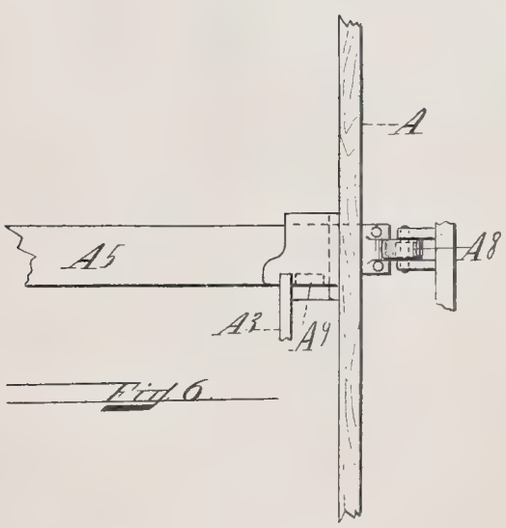

Fig. 6.

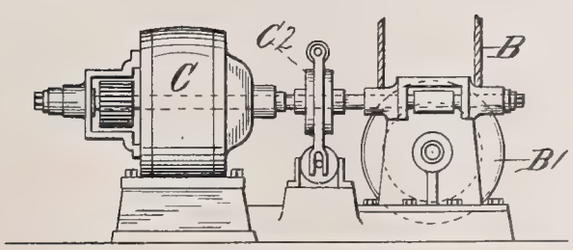

Fig. 7.

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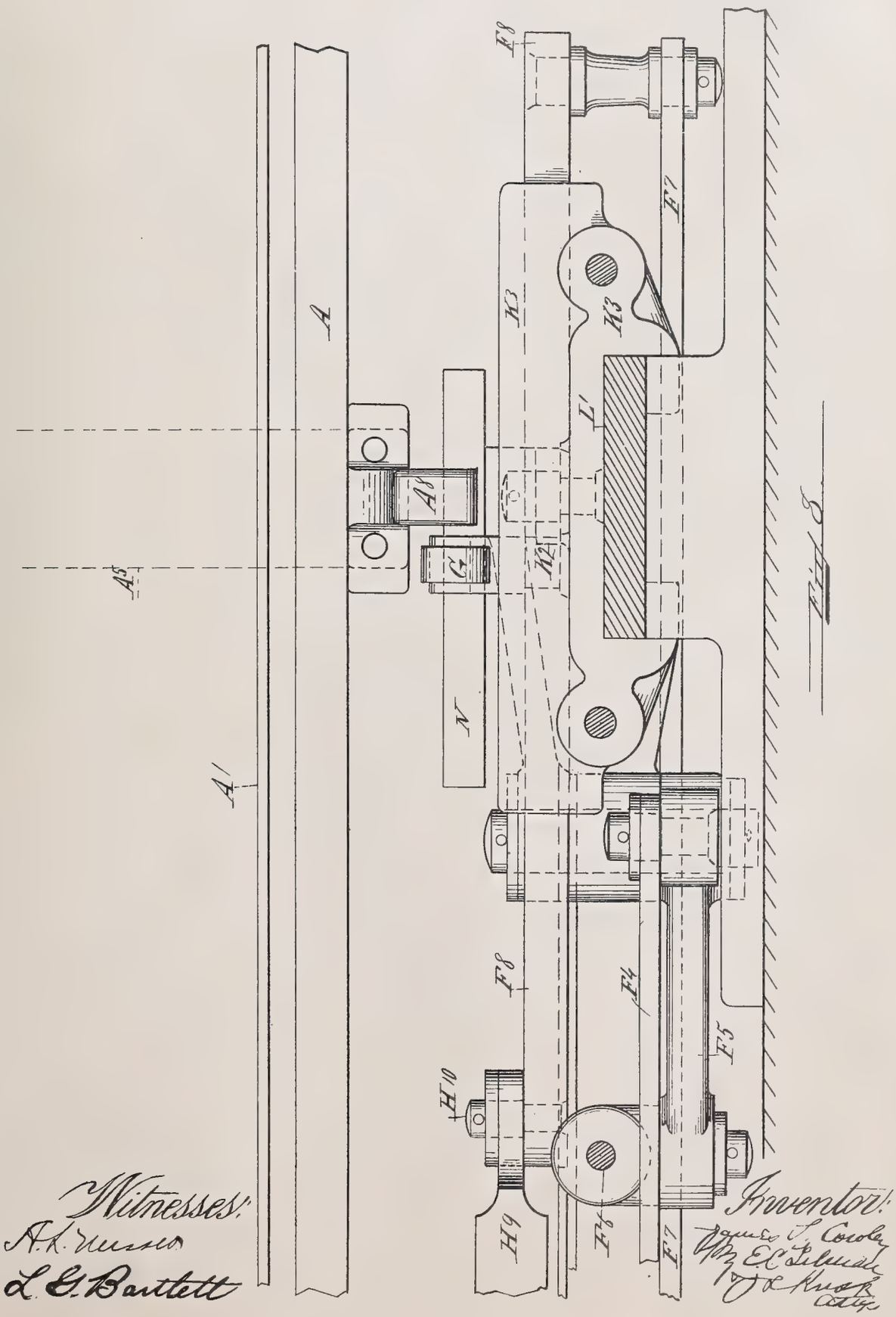
5 SHEETS—SHEET 4.



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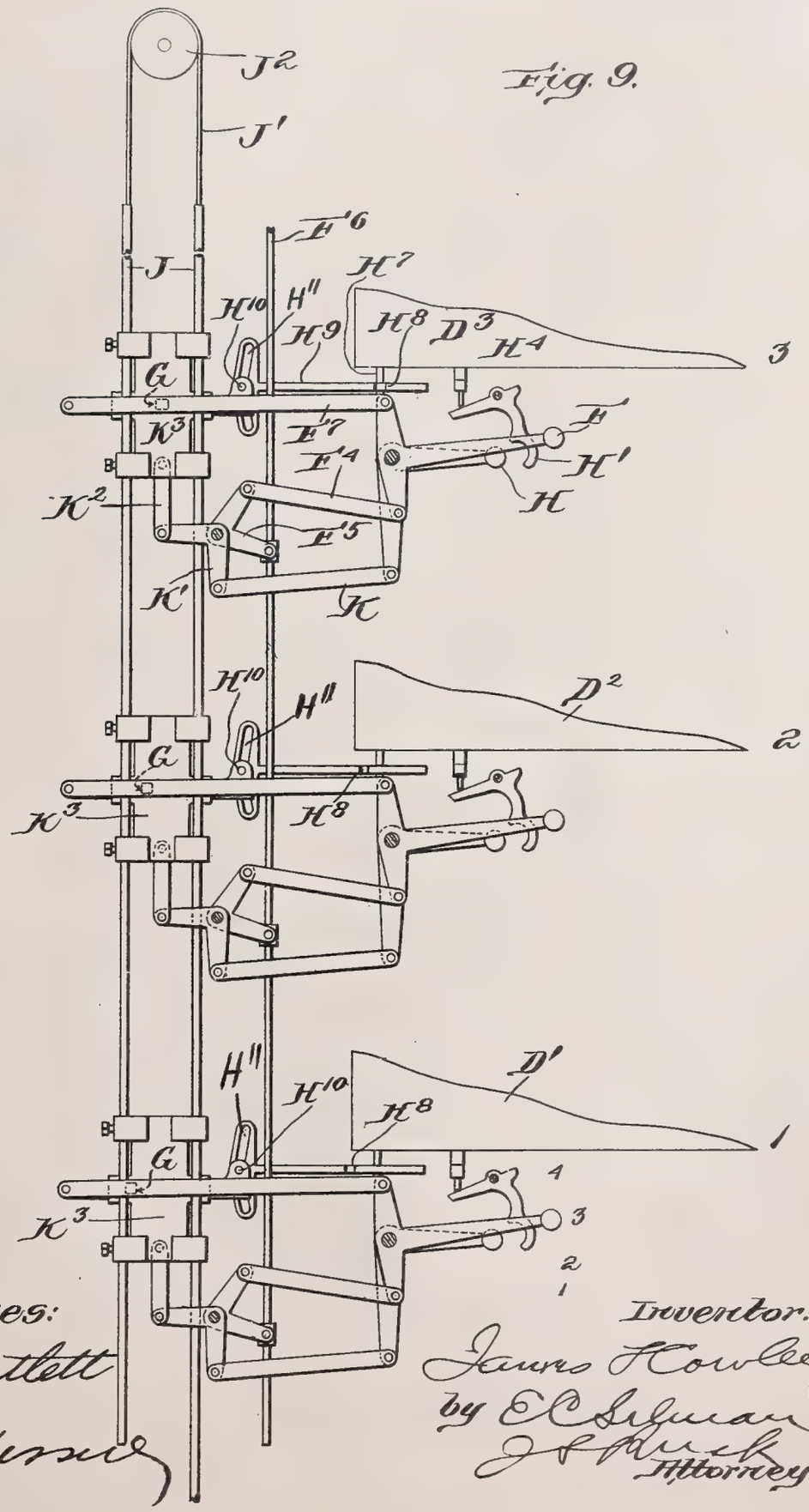
APPLICATION FILED JULY 17, 1905.

928,364.

Patented July 20, 1909.

5 SHEETS—SHEET 5

Fig. 9.



Witnesses:

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UNITED STATES PATENT OFFICE.

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ELEVATOR.

No. 928,364. Specification of Letters Patent. Patented July 20, 1909.

Application filed July 17, 1905. Serial No. 269,974.

To all whom it may concern:

Be it known that I, JAMES T. COWLEY, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Elevators, of which the following is a specification.

My invention relates to elevators and the like and has for its object to provide an elevator apparatus wherein the car may be started from any one of its stopping points and sent to any other selected one of its stopping points and automatically stopped there.

Also it is the object of my invention to provide an elevator apparatus which can be operated only when all of the doors of the well through which access may be had to the car are closed.

Furthermore it is the object of my invention to provide for locking all of the doors of the apparatus except the one at which the car is stopped or to be stopped.

To these ends my invention is an elevator apparatus comprising a car, means to operate the car, a plurality of stopping points along the path of said car, and means to select any one of these stopping points to the exclusion of the others and automatically stop the car at that point. In the preferred form of my invention a selecting device is provided at each stopping point and interconnected car-stopping devices are provided, one at each stopping point, all of which may be controlled by any one of the selecting devices. These stopping devices are so constructed that any one of the selecting devices may be used to throw them successively into operative condition so that any one of them may be rendered operative to the exclusion of the others. In this way the car may be made to stop at any selected one of its stopping points.

Another feature of my invention in its preferred form is that a door is provided at each stopping point which is the only means of access to the car and automatic means is provided for controlling these doors so that when the car is running or about to be started all of these doors are shut and locked except the door at the selected stopping point. Preferably, also, these doors control the elevator-operating means so that the car cannot be started except when all of the doors are closed.

Other features of my invention are hereinafter pointed out.

In the accompanying drawings which illustrate one form of my invention—Figure 1 is a side elevation of an elevator apparatus showing general arrangement. Fig. 2 is a plan view of the mechanism located at each floor and showing section of the elevator car. Fig. 3 is a side elevation of the parts shown in Fig. 2. Fig. 4 is a front view of the lower part of the car. Fig. 5 is an edge view of the lower part of the slide or door showing latch and controlling bar for same. Fig. 6 is a plan view of a portion of Fig. 4. Fig. 7 is an enlarged view of motor and cable drum. Fig. 8 is an enlarged view of a portion of Fig. 2, and Fig. 9 is a diagram showing the mechanisms at three of the stopping points and the manner in which they are connected together, the parts being in the positions they would occupy when any one had been adjusted so as to stop the car at stopping point or floor number 3.

Referring to the drawings, 1, 2, 3, and 4 represent the floors of a building through which the elevator well extends. Within the well is the car A carried by rope B, supported near the top of the building by a sheave B^2 on a shaft B^3 journaled in a suitable hanger. In the basement of the building is a motor C that drives a drum B′ around which the rope B passes and this motor is controlled by a rheostat C′. At the different floors of the building the elevator is accessible through doors D′, D^2, D^3, and D^4 which slide vertically in ways.

The starting of the elevator is effected through a bell crank H (Figs. 2 and 3) connected by a link K with a smaller bell crank K′ connected by a link K^2 with a slide K^3 mounted on a vertical bar L′. The bar L′ which carries the slide K^3 is fixed at its ends to brackets L fastened to the wall of the elevator well. This slide K^3 is made with bosses through which extend two rods J connected at their upper ends by a belt or chain J′

passing over a sheave J^2. One of the rods J is fastened rigidly to the slide K^3 and the other rod J slides loosely through the bosses of said slide and at its lower end said rod is connected by a bell crank C^4 and links C^3 with the motor-controlling rheostat C′ so that vertical movement of that rod J starts and stops the motor C. The reason for employing the two rods J connected by the belt or chain J′ as described is so that one rod will serve to counterbalance the other, thus reducing the labor in operating that rod J which is connected with the controller C′. It will thus be seen that by means of the bell crank H the motor C may be started, said motor being stopped automatically as described later.

In order to prevent the operation of the car A when any of the doors D′, etc., are open, or in other words, in order to permit of operating the car A only when all of the doors are closed each bell crank H is controlled by a latch H′ which in turn is controlled by its respective door. This latch H′ is pivoted at H^6 and a spring H^2 tends to hold said latch in engagement with the bell crank H but when the door is closed a stud H^4 on the door engages a pin H^5 sliding in any suitable fixture and acting through said pin H^5 engages the arm H^3 of the latch H′ thereby freeing the bell crank H so that the latter may be operated to start the car A up or down. The "off" position of the bell crank H is midway between the extremes of its movement which is the case also with the arm of the controller C′ so that if the bell crank H is swung down the controller arm is swung in one direction and a motor C is started in one direction and if the bell crank H is swung in the opposite direction the controller arm is swung in the opposite direction and the motor C is started in the opposite direction. It will be seen, however, that if the door is open the latch H′ locks the bell crank H in its "off" position and the car cannot be operated.

The studs which carry the bell cranks F and H are fixed to a wall E′, E^2, etc., on the different floors. This wall may be part of the building within which the apparatus is located.

As will be seen from Fig. 9 all of the slides K^3 are rigidly connected by the rod J that is fastened to said slides and therefore if any of the doors is open and its respective bell crank H is locked none of the other bell cranks can be operated even though their respective doors are closed and consequently in order to start the car in either direction all of the doors must be closed.

In accordance with the invention it is desired to be able to start the car from any floor and automatically stop it at any of the other landings or stopping points and in order to accomplish this the selecting and stopping devices now to be described are provided.

Mounted loosely on the same stud with the bell crank H is a double bell crank F which has connected to it two links F^4 and F^7. The link F^4 is connected through a bell crank F^5 pivoted on the bar L′ with an interlocking rod F^6 which is common to all of the bell cranks F, all of said bell cranks being connected in similar manner with said rod. The other link F^7 is connected with a slide F^8 mounted in transverse ways on the slide K^3. This slide F^8 carries a roll G and a pin H^{10}. There is an index alongside of the bell crank F corresponding to the stopping points or floors of the building and the rolls are so placed on their respective slides F^8 that when the bell crank F is opposite 1 on the index then the roll G of the first floor or stopping point is in the path of a cam A^8 carried by the car and all the other rolls G are out of the path of said cam. When a bell crank F is shifted opposite 2, 3, or 4 on the index, then the roll G of the floors 2, 3, or 4, is brought into the path of the cam A^8 while the other rolls G will be out of the path of said cam. The doors D′, etc., each carries a latch H^7 normally held by a spring H^{12} surrounding a pin H^{13} in engagement with a slide H^9. This slide H^9 is made with a notch H^8 which serves as a passageway for the hook of the latch H^7 when the notch is brought into the path of said hook. The notches H^8 of the different slides are positioned so that when the bell crank F is opposite 1 on the index, notch H^8 of the floor 1 is on the path of the latch H^7 of that floor while all the other latches H^7 are in locking engagement with the slides H^9. Likewise the notches H^8 of the floors 2, 3, and 4 free their latches H^7 only when the bell crank F is opposite 2, 3, or 4 on the index. That is to say, only one latch H^7 is freed at a time and that when the bell crank F is opposite the number on the index that corresponds to the floor of the latch that is free so that only one door of the whole series is free to be opened at one time. The slide H^9 is engaged by the pin H^{10} on the slide F^8 and when the bell crank F is shifted to select the stopping point for car A the roll G at the stopping point selected on the index adjacent the bell crank F is brought into the path of the cam A^8 and at the same time the pin H^{10} shifts the slide H^9 at the selected stopping point so as to free the latch H^7 that coöperates therewith. This selection having been made the operator throws the bell crank H up or down according to the direction in which he desires the car to travel. As soon as the cam A^8 strikes the roll G at the selected stopping point the car is automatically stopped and dumped. The stopping is effected as follows: The cam A^8 lifting on the roll G raises the slide

K^3, rod J, as well as all of the other slides K^3 that are connected with said rod which results in a downward movement of the loose rod J thereby shifting the controller C' so as to stop the motor C. It will thus be seen that the car A may be started from any floor and automatically stopped at any selected one of its stopping points and that the door at that stopping point is automatically unlocked.

The bottom A' of the car A is pivoted at A^2 and this pivoted bottom is normally supported by two latches A^3 pivoted thereto and resting on two latches A^3—A^4 on a bar A^5 that is made with two notches A^9 and A^{10}. The bar A^5 is mounted on slides on the car A and carries the cam A^8, said rod being normally held with cam A^8 projected so as to engage with the rolls G by a spring A^6. When during the travel of the car the cam A^8 strikes the roll G at the selected stopping point the bar A^5 is slid in the direction indicated by the arrow in Fig. 4 far enough to bring the notches A^9 and A^{10} opposite the latches A^3 and A^4. The latter being then unsupported the bottom A' tilts and the contents of the car is discharged onto a trough or the like S at the selected stopping point. The cam A^8 as shown in Fig. 4 is made with two inclines one extending up and the other down from a pocket which separates the two inclines so that during the travel of the car in either direction the incline which engages the roll G first acts to the shift bar A^5 so as to free the bottom A' and then when the roll G enters the pocket between the two inclines said roll is carried with the car and its movement acts as described to stop the motor C.

The slot H^{11} into which the pin H^{10} projects is elongated as shown in Fig. 9 to permit the starting and stopping movements of the slides K^3 referred to.

From the above description it will be seen that the rolls G are interconnected and positioned so that they not only move together but no two of them are in the path of the cam A^8 at once; that all of the slides K^3 are connected so as to move together and so that when the cam A^8 engages one of the rolls G to raise or lower any one of said slides the motor C will be stopped; that all of the slides H^9 are connected so as to move together and their notches H^8 are so positioned as to successively free their latches H^7, and that the bell cranks F are all connected so as to work together and shift their links F^4 and F^7 correspondingly.

Fig. 9 of the drawings shows the selecting, stopping and door-controlling and controlled mechanisms of the first three floors of the building illustrated in Fig. 1. In said Fig. 9, however, the parts are shown in the positions they occupy after the operator at the 1st, 2d, or 4th floor has adjusted the mechanism to stop the car A at the third floor. If the car be at the fourth floor the operator at that point after shifting the handle F into position opposite "3" on the index, as shown at floor 1 of Fig. 9, next throws bell crank H down and motor C is started in a direction to lower car A. The car A then descends until the cam A^8 engages the roll G at the third floor whereupon the car is stopped and emptied automatically. If the car A is at the first or second floor, then the operator at either of those points throws the bell crank H up and the car A is lifted by the motor C until the cam A^8 engages the roll G with the results described. As will be clear from Fig. 9, the car can not be started in either direction unless all of the doors are closed and when the bell crank F is adjusted to select any one of the floors as the stopping point for the car the door at that floor is automatically unlocked by the notch H^8 being brought opposite or into the path of the hook of latch H^7 and at the same time all of the other notches H^8 are carried out of the path of their coöperating latches H^7.

Having thus described the nature of my invention, and set forth a construction embodying the same, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In an elevator, a car, means for raising and lowering said car, a controller for said raising and lowering means, a plurality of mechanisms for operating said controller, a plurality of adjustable members adapted to be moved by the car to actuate respectively said controller-operating mechanisms, means common to all of said adjustable members for simultaneously moving the same, and selective mechanism operating through said means common to the adjustable members to position any one of such members to be engaged by the car to actuate its controller-operating mechanism.

2. In an elevator, a car, means for raising and lowering said car, a controller for said raising and lowering means, a plurality of mechanisms for operating said controller, a plurality of adjustable members adapted to be moved by the car to actuate respectively said controller-operating mechanisms, a plurality of door-locking mechanisms respectively actuated by said adjustable members, means common to all of said adjustable members for simultaneously moving the same, and selective mechanism operating through said means common to the adjustable members to position any one of such members to be engaged by the car to actuate its controller-operating mechanism and to actuate its door-locking mechanism.

3. In an elevator, a car, means for raising and lowering said car, a controller for said raising and lowering means, a plurality of

mechanisms for operating said controller, a plurality of door-controlled mechanisms respectively holding said controller-operating mechanisms against movement when their doors are open and releasing the same when the doors are closed, a plurality of adjustable members adapted to be moved by the car to actuate respectively said controller-operating mechanisms, means common to all of said adjustable members for simultaneously moving the same, and selective mechanisms operating through said means common to the adjustable members to position any one of such means to be engaged by the car to actuate its controller-operating mechanism.

4. In an elevator, a car, means for raising and lowering said car, a controller for said raising and lowering means, a plurality of vertical slides connected with said controller, means connected with said slides to vertically move the same to actuate the controller, slides adjustable transversely on said vertical slides, members differently located on said transversely adjustable slides adapted to be engaged by the car to actuate the vertical slides, a rod connecting said transversely adjustable slides, and selective means operating through said rod to simultaneously move all of said transversely adjustable slides to position one or another of said members to be engaged by the car.

5. In an elevator, a car, means for raising and lowering said car, a controller for said raising and lowering means, a plurality of vertical slides connected with said controller, means connected with each slide to vertically move the same to actuate the controller, slides adjustable transversely on said vertical slides, members differently located on said transversely adjustable slides adapted to be engaged by the car to actuate the vertical slides, a plurality of door-locking mechanisms respectively actuated by said transversely adjustable slides, a rod connecting said transversely adjustable slides, and selective mechanism operating through said rod to simultaneously move all of said transversely adjustable slides to position one or another of said members to be engaged by the car and to simultaneously operate all of said locking mechanisms.

6. In an elevator, a car, means for raising and lowering said car, a controller for said raising and lowering means, a plurality of mechanisms for operating said controller, latches for said controller-operating mechanisms, door-actuated means for operating each latch to hold its respective controller-operating mechanism when the door is opened and to free the same when the door is closed, a plurality of adjustable members adapted to be moved by the car to actuate respectively said controller-operating mechanisms, means common to all of said adjustable members for simultaneously moving the same, and selective mechanism operating through said means common to the adjustable members to position any one of such members to be engaged by the car to actuate its controller-operating mechanism.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this seventh day of July A. D. 1905.

JAMES T. COWLEY.

Witnesses:
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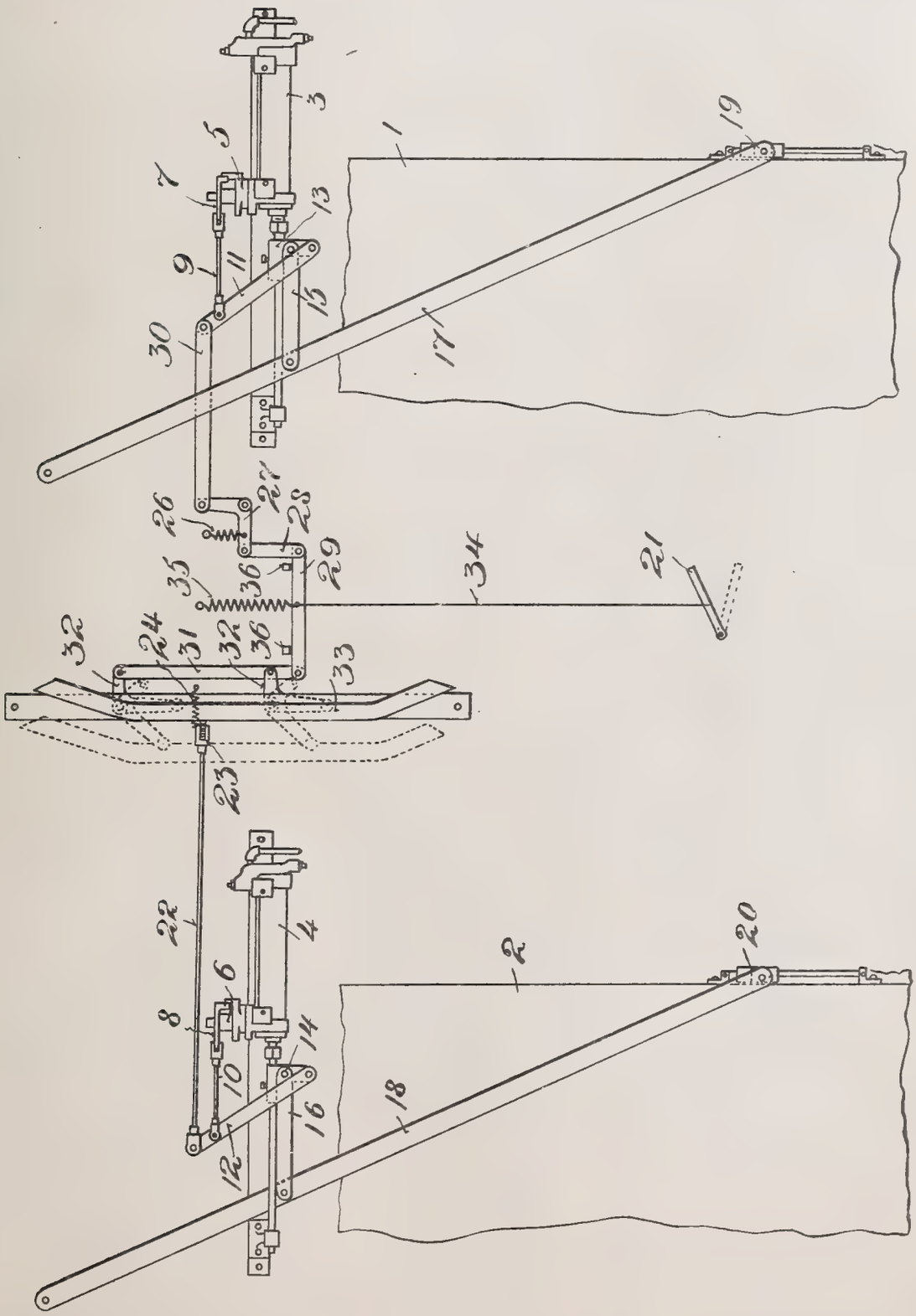
G. F. MAGNITZKY.

H. ROWNTREE.

ELEVATOR CAR AND WELL DOOR OPERATING MECHANISM.

APPLICATION FILED SEPT. 21, 1907.

931,224. Patented Aug. 17, 1909.



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UNITED STATES PATENT OFFICE.

HAROLD ROWNTREE, OF CHICAGO, ILLINOIS, ASSIGNOR TO BURDETT-ROWNTREE MANUFACTURING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

ELEVATOR CAR AND WELL DOOR OPERATING MECHANISM.

No. 931,224. Specification of Letters Patent. Patented Aug. 17, 1909.

Application filed September 21, 1907. Serial No. 393,912.

To all whom it may concern:

Be it known that I, HAROLD ROWNTREE, a citizen of the United States, residing at Chicago, county of Cook, State of Illinois, have made a certain new and useful Invention in Elevator Car and Well Door Operating Mechanism, of which the following is a specification.

This invention relates to elevator car and well door operating mechanism.

The object of the invention is to provide means whereby the car door operating means cannot be put in operation until the car arrives adjacent an inclosure or well door.

A further object is to provide means whereby the door on the car, and a door of the inclosure or elevator shaft or well are operated in unison and neither can be operated alone.

A further object is to provide means which are simple and efficient for simultaneously controlling the operation of car and inclosure or well doors.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in the construction, combination, location and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawing and finally pointed out in the appended claims.

The single view of the drawing shows in elevation, and somewhat diagrammatically, a construction of coöperating car door and inclosure or well door operating mechanisms and their interconnections, and embodying the principles of my invention.

For clearness of illustration and description I have shown the car door operating mechanism at one side and the inclosure or well door operating mechanism at the other side of the view of the drawing, but it is to be understood that in practice when the car is in the required position for the door thereon to be opposite a shaft or well door, for the two doors to be simultaneously operated, the operating mechanism for the one door is directly behind that of the other door.

Where operating mechanism has been employed not only for the door on the car but also for the doors of the car inclosure or elevator shaft or well, it has hitherto been a common practice to so construct, arrange and install the mechanisms that the car door could be opened at any time. It has also been a common practice to so arrange the inclosure door operating mechanism so that such door cannot be operated until the car arrives opposite or adjacent such door. The capability of the car door to be operated at any time whether the car is opposite a floor or landing or not, is objectionable and dangerous in that through the opening of such door before the car arrives at a floor or landing, or while the car is in motion, the danger is incurred of passengers on the car attempting to step through the car door opening and hence being caught or jammed between the floor of the car and the ceiling of the floor or landing, or other projecting ledge, in case the car is ascending, or the ceiling or roof of the car, and the floor or landing or other projecting ledge or shoulder of the shaft or well in case the car is descending. Serious and often times fatal accidents have occurred in this manner in the operation of elevators. It is among the special purposes of the present invention to provide means for avoiding the danger referred to and to render the operation of elevators more safe.

In accordance with the principles of the present invention I propose to provide means whereby when operating devices are employed for the elevator shaft, well or inclosure doors and also for the car door, through suitable connections controlled by the control mechanism for the car door operating mechanism, such car door operating mechanism cannot be operated until the car arrives adjacent the inclosure door, and approximately level with the floor or landing, and when the car arrives at the required point then the car door and inclosure door are simultaneously operated.

While I have shown and will now describe one construction and arrangement for accomplishing this result, and the best form in which I at present contemplate carrying my invention into practical operation, I desire it to be understood that my invention is not to be limited or restricted to the construction disclosed as the principles thereof may be embodied in a wide variety of different constructions without departure from the spirit and scope of my invention.

In the drawing reference signs 1 and 2 designate respectively the elevator car door and a landing or inclosure door.

The mechanisms for operating the doors may or may not be the same in construction

and arrangement, so far as the present invention is concerned. To illustrate the principles of my invention, however, I have shown the same construction of power mechanism for operating the doors. This mechanism consists of power cylinders 3, 4, to which power medium may be supplied, such medium, in the supply and exhaust thereof, being controlled by valve devices 5, 6, having operating arms 7, 8, connected by links 9, 10, to levers 11, 12. The pistons of the power cylinders operate cross heads 13, 14, which are connected by links 15, 16, to door operating levers 17, 18, pivotally mounted, and having suitable sliding connection as at 19, 20, with the doors 1, 2. The lever 11, of the car door operating mechanism is pivotally connected at one end to the cross-head 13, and at the other end, through suitable intermediate connections, to the control lever 21. Similarly, the lever 12 of the inclosure door is pivotally connected at one end to the cross-head 14, and at the other end through a link, rod or other connection 22, to a lever 23, the latter being acted upon by a spring 24, the tension of which operating through lever 23, rod 22, lever 12, link 10, and arm 8, normally tends to hold the control valve 6, in position to maintain the door 2, closed.

It is to be understood that the door 2, and its associated power operating mechanism, including the link or rod 22, lever 23 and spring 24, are erected in the inclosure and at the floor or landing at which the car is to stop, and that each landing or inclosure, if so desired, is similarly equipped. It is also to be understood that the door 1, and its associated power operating and control mechanism, and, in fact, all the other devices and mechanism hereinafter to be referred to and constituting features of my invention are mounted upon the elevator car. It is also to be understood that while I have shown and described a specific construction and arrangement of power and control mechanism for operating the doors in order to illustrate my invention, any other form and construction of such mechanism may be employed and may well answer the required purpose.

I will now describe a construction and arrangement whereby the operation of the car door is rendered impossible until the car arrives opposite or adjacent a landing or floor, but when the car is opposite or adjacent the landing or floor, then both the car and the inclosure doors are operated simultaneously, this being the important and valuable feature of my invention.

Interposed in the connection between the control lever 21, and the motor controller 5, is a spring 26, the tension of which normally tends to maintain the controller in position to keep the door 1, closed. In the particular form shown, to which the invention is not to be limited or restricted, however, the spring 26, is connected to and acts upon one arm of a bell crank lever 27, said arm being connected by a link 28, to one end of a bar 29. The other arm of said bell crank lever 27, is connected by means of a link 30, with the end of lever 11. The other end of bar 29 is connected to a sliding rod 31, which is connected, through crank arms 32, with trip shoe 33. The bar 29, is connected intermediate its ends, through a rod or other connection 34, with the control lever 21, but is normally held by a spring 35, against back stops 36.

From the foregoing description it will be seen that in their normal positions, as shown in full lines, the bar 29 is held against its back stops 36, the doors 1 and 2 are held closed, and the trip shoe 33 is held retracted. Under these conditions the car may be operated up or down without incurring the danger of injury or accident due to the inopportune opening of the car door, the retracted position of the trip shoe 33, enabling said shoe to pass freely by the levers 23, of the inclosure door controlling mechanisms without operating the same. Now, suppose the car door control lever 21 is rocked into the position shown in dotted lines and before the car arrives opposite a floor or landing. In such circumstances the trip shoe 33 is free to be moved outwardly unrestrained by reason of the fact that there is nothing in front of it to oppose such movement. Any movement of the other end of bar 29, however, under the pull exerted by the rocking of control lever 21, is opposed by the tension of spring 26; the result, therefore, is that instead of bar 29 moving bodily and parallel to itself, it tilts or rocks about its point of pivotal connection with link 28, as a fulcrum and merely throws out the trip shoe 33, but does not operate the motor controller 5, and hence the car door remains closed. The throwing out of the trip shoe is not productive of any result since, under the condition assumed, the car is not opposite a landing or inclosure door. Now suppose the car is opposite a landing or inclosure door at the time the car door control lever 21 is rocked, then, instead of the trip shoe 33, being unopposed in its outward movement, it encounters the lever 23 and the tension of spring 24. The tension of this spring is arranged to equal that of spring 26. The result is that an equal resistance is imposed upon the respective ends of bar 29, and consequently, instead of said bar rocking or tilting about one end as before noted, it moves bodily and parallel with itself away from the back stops 36, and not only throws out the trip shoe, thereby operating the landing or inclosure door operating motor controller, but it also effects the operation of the car door motor

controller, and hence the two doors are operated in unison.

Of course it will be understood that if the control lever 21 is rocked to position indicated by dotted lines before the car reaches a position opposite a landing or inclosure door, and is held in such position, then, when the car reaches a position approximately level with the next floor or landing the projected trip shoe 33 will engage the lever 23, and the resulting tension imposed on the trip shoe and through it and its connections, to the bar 29, will cause said bar to move into such position as to cause the car door motor controller to operate, so that both the car door and the inclosure door will be operated to open position. From this it will be seen that it is not necessary to wait till the car reaches its position opposite or adjacent the floor landing or inclosure door before the control lever 21, is operated, but the operation of such lever, before the point is reached, will be ineffective and will remain ineffective until the car reaches the desired point when its operation becomes effective.

While I have described my invention as applied to elevator car and inclosure doors, it is to be understood that the same construction and principles may be applied to other doors as, for instance, to the doors on elevated railway cars, so that the door could not be opened until the car had reached a platform, or a certain part of a platform, if desired. The invention is also applicable to other uses and purposes and to other situations. It is also evident that instead of applying my invention to doors it is equally well adapted to other forms of closures or passage obstructions and similar purposes. It is also obvious that instead of applying the invention to sliding doors is is equally well adapted to hinged or pivoted or other construction of doors.

Having now set forth the object and nature of my invention and a construction embodying the principles thereof, and having described such construction, its purposes, function and mode of operation, what I claim as new and useful and of my own invention and desire to secure by Letters Patent is:

1. In an elevator door operating mechanism, a car door, and a landing door, power mechanisms respectively arranged to move said doors, means for controlling said power mechanisms, and means for rendering said controlling means inoperative until the car arrives adjacent a landing or inclosure door.

2. In an elevator door operating mechanism, a car door, and a landing door, independent power mechanisms for operating the same, and means for rendering both power mechanisms idle until the car arrives adjacent a landing or inclosure door.

3. In an elevator door operating mechanism, a car door, a landing door, independent power mechanisms for operating the same, a controller for said power mechanisms and means for rendering said controller inoperative until the car arrives adjacent a landing or inclosure door.

4. In an elevator door operating mechanism, a car door, power mechanism for operating the same, a controller for said power mechanism, an operating lever for said controller, and means whereby the said lever is free to operate without operating said controller until the car arrives adjacent a landing or inclosure door.

5. In an elevator door operating mechanism, a car door, power mechanism normally operating to maintain said door closed, controlling mechanism therefor, and means for rendering the operation of said controlling mechanism ineffectual until the car arrives adjacent a landing or inclosure door.

6. In an elevator door operating mechanism, an inclosure door and a car door, independent devices for simultaneously operating said doors and a single control mechanism for said devices, said control mechanism being inoperative except when the car door is adjacent the inclosure door.

7. In an elevator door operating mechanism, an inclosure door and a car door, independent means for moving said doors and a common means normally inoperative and rendered operative when the car door is adjacent the inclosure door, for controlling the operation of the moving means for both doors.

8. In an elevator door operating mechanism, an inclosure door and a car door, independent devices for operating said doors in unison and means normally inoperative and rendered operative when the car door is adjacent the inclosure door for rendering said devices operative to open both doors.

9. In an elevator door operating mechanism, an inclosure door and a car door, independent power mechanisms for operating said doors, and means normally inoperative and rendered operative when the car door arrives adjacent the inclosure door for controlling said power mechanisms to simultaneously open both doors.

10. In an elevator door operating mechanism, an inclosure door and a car door, independent devices for operating said doors, and means for rendering said devices simultaneously effective to open said doors when the car door arrives adjacent the inclosure door.

11. In an elevator door operating mechanism, an inclosure door and a car door, independent motors for operating said doors, and devices for simultaneously controlling said motors when said doors are adjacent each other.

12. In an elevator door operating mech-

anism, an inclosure door and a car door, independent motors for operating said doors, said motors normally operating to maintain said doors closed, and means for controlling said motors simultaneously to open said doors when said doors are adjacent each other.

13. In an elevator door operating mechanism, an inclosure door and a car door, independent means for moving said doors, means carried by the car for controlling the inclosure door operating means, said means also operating to simultaneously control the car door operating means when said doors are adjacent each other.

14. In an elevator door operating mechanism, an inclosure door and a car door, independent motors for operating said doors, means for controlling the inclosure door motor, said means also controlling the car door motor when said doors are adjacent each other.

15. In an elevator door operating mechanism, an inclosure door and a car door, independent motors for operating said doors, a controller for each motor and means rendered operative when said doors are adjacent each other for simultaneously operating said controllers.

16. In an elevator door operating mechanism, an inclosure door and a car door, independent motors for operating said doors, a control lever for both motors, and connections intermediate said lever and motors for controlling the latter said connections being effective when said doors are adjacent each other.

17. In an elevator door operating mechanism, an inclosure door and a car door, independent motors for operating said doors, a control device for each motor, a bar having connections at its respective ends to operating devices for said controllers and a lever for moving said bar.

18. In an elevator door operating mechanism, an inclosure door and a car door, independent motors for operating said doors, a trip shoe for controlling the inclosure door operating motor, a control lever for the car door operating motor, connections between said lever and trip shoe, and means arranged to be engaged by said trip shoe when said doors are opposite each other, whereby both motors are simultaneously operated.

In testimony whereof I have hereunto set my hand in the presence of the subscribing witnesses, on this 10th day of September A. D., 1907.

HAROLD ROWNTREE.

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L. M. SHIELDS.

L. J. MILKE.

AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

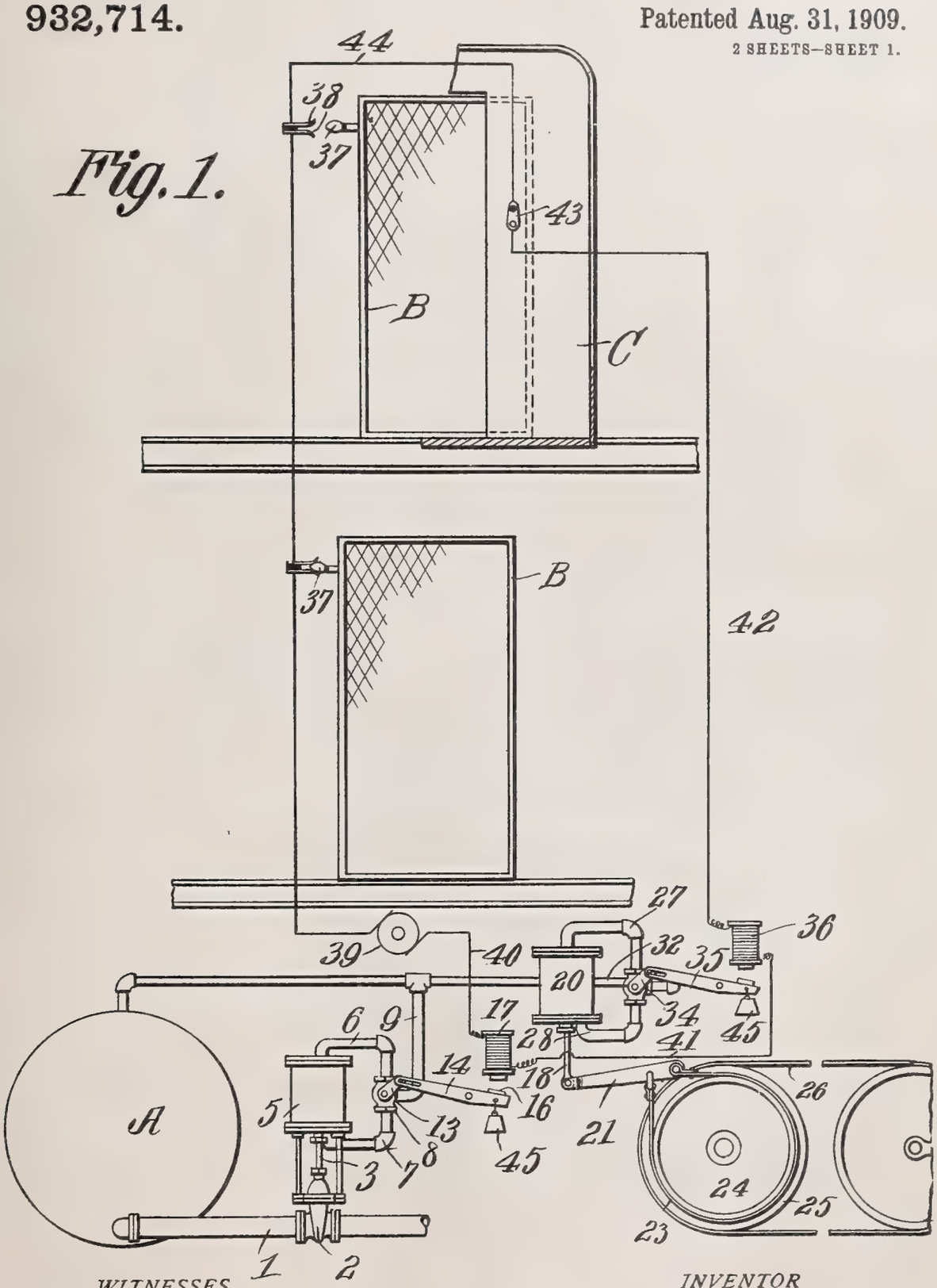
APPLICATION FILED AUG. 11, 1908.

932,714.

Patented Aug. 31, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

APPLICATION FILED AUG. 11, 1908.

932,714.

Patented Aug. 31, 1909.

2 SHEETS—SHEET 2.

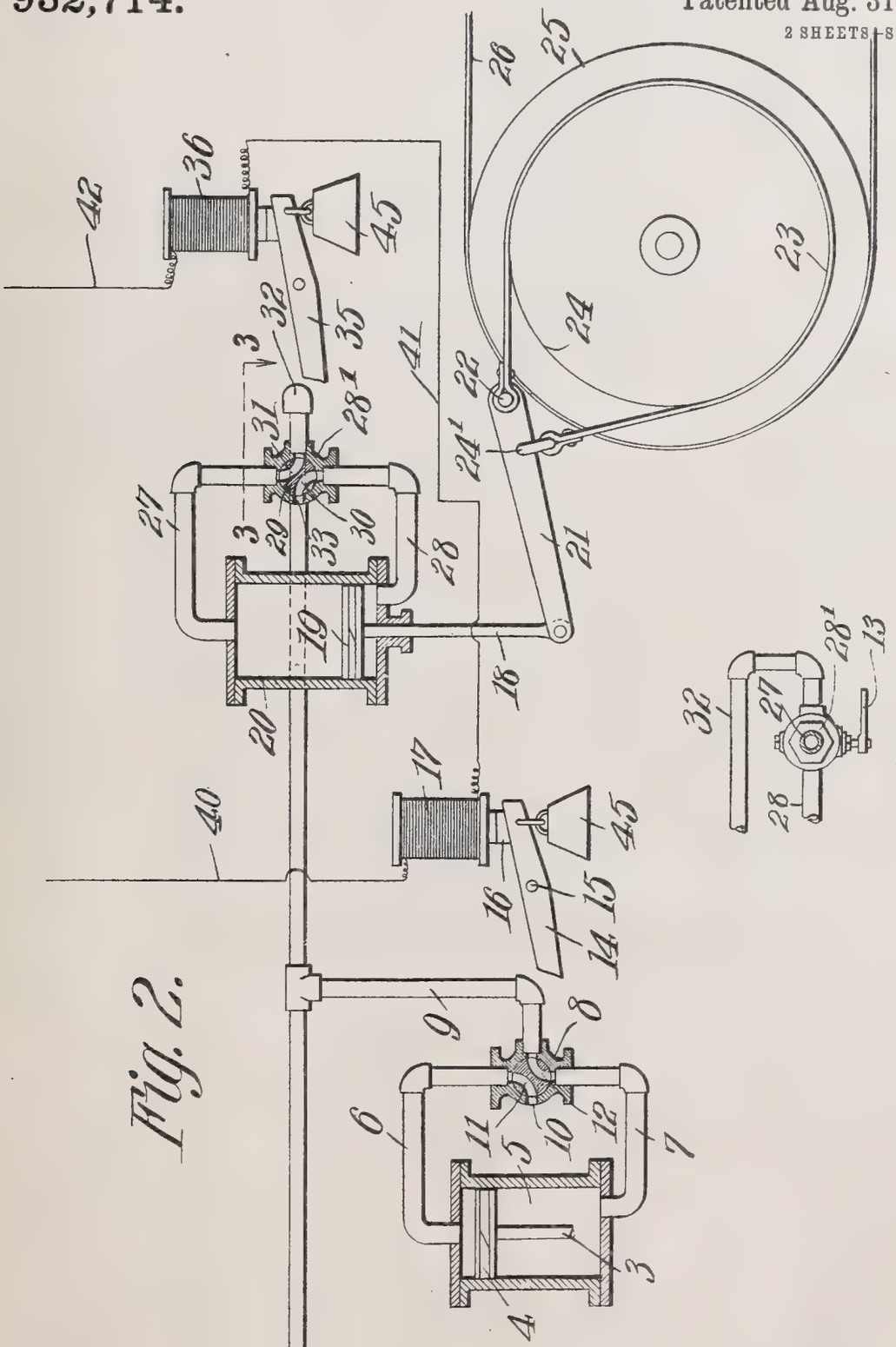

Fig. 2.

Fig. 3.

WITNESSES

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UNITED STATES PATENT OFFICE.

LOUIS J. MILKE, OF BALTIMORE, MARYLAND.

AUTOMATIC CONTROL DEVICE FOR ELEVATORS.

932,714. Specification of Letters Patent. Patented Aug. 31, 1909.

Application filed August 11, 1908. Serial No. 447,925.

To all whom it may concern:

Be it known that I, LOUIS J. MILKE, a citizen of the United States, residing at Baltimore city, State of Maryland, have invented certain new and useful Improvements in Automatic Control Devices for Elevators, of which the following is a specification.

My invention relates to automatic control devices for elevators, and has for its object means by which the operation of the elevator is automatically controlled by the opening and closing of the elevator door.

The device has for its particular object to prevent the starting of the car, after it has been stopped at a particular landing, and the door opened without the door first having been closed. The device being so constructed that after the car has been stopped at a particular landing, and the door having been opened, it is impossible to again start the car without the door first having been closed, thereby lessening to a degree, the possibility of accident to a passenger in the entering or leaving the car, occasioned by the premature starting thereof, by preventing the starting of the car until the passenger has fully entered or passed out therefrom.

With the foregoing object in view, my invention consists in certain novel features of construction and combinations of parts which will be hereinafter described and pointed out in the claims.

In the accompanying drawing Figure 1 is a side elevation of the mechanism in the position assumed when one of the doors to the elevator shaft is opened. Fig. 2 is a similar view of a part of the mechanism shown in Fig. 1, drawn to an enlarged scale, there being parts in section and parts broken away. The operative parts are in a position opposite to that shown in Fig. 1. Fig. 3 is a sectional plan view of a part of Fig. 2 taken on the line 3—3.

Like characters of reference indicate similar parts throughout the several figures of drawings in which A indicates a tank of fluid under pressure, connecting this tank and the elevator piston (not shown) is the usual supply pipe 1, and in this line of pipe is interposed an ordinary gate valve 2, the stem 3 of which is a continuation of the piston rod of a piston 4 adapted to reciprocate within a cylinder 5. Opening into the said cylinder 5 at either end thereof are pipes 6 and 7, said pipes serving in opposed alternation as feed and exhaust pipes through the medium of the four-way valve 8 into which one end of each of the pipes 6 and 7 are fitted. Also fitted to this valve casing 8 is one branch of a supply pipe 9 in communication with the tank A, or other source of pressure. At a point diametrically opposite where the said pipe 9 enters the valve casing is an exhaust port 10.

The barrel of the valve is provided with ports 11 and 12, said ports being adapted to bring the several pipes into communication as will presently appear. To the stem of the valve barrel is fixed a lever 13 connected to another lever 14 by a pin and slot connection, said lever 14 being pivoted at 15 to some fixed part of the apparatus, and carrying on its outer end an armature 16 adapted to be attracted by a magnetic coil 17, when same is energized. Connected to the piston rod 18 of a piston 19, fitted to a cylinder 20, is a lever 21, pivoted at 22, to some fixed support (not shown), and having a band 23 extending around a drum 24 and attached to the said lever at a point intermediate of its ends as indicated at 24′, the whole constituting what is commonly known as a band brake. Fixed to the said drum 24 is a pulley 25 over which passes a belt or rope 26, said rope being operatively connected to the hoisting mechanism of the elevator car, so that when the car is moved, the pulley 25 will be caused to rotate.

Connected to the cylinder 20 are two pipes 27 and 28 similar to the pipes 6 and 7, and similarly connected to a valve 28′ having a barrel 29 provided with ports 30 and 31. This valve receives a supply of fluid under pressure through a pipe 32 and is also provided with an exhaust port 33. Fixed to the stem of the valve barrel 29 is a lever 34 connected to a lever 35, similar to the lever 14 and under the action of the magnetic coil 36.

Fixed to each of the doors B opening to the elevator shaft, is a plug 37, adapted, when the door is closed to engage the terminals 38 of an electric circuit, thereby closing the circuit which is here diagrammatically shown.

From a source of electrical energy here shown as a dynamo 39 through a conductor 40, through the coils 17, thence by the conductor 41, through the coil 36, through the conductor 42, through the switch 43, located in the elevator car C, thence over the conductor 44 consecutively through the cir-

cuit breakers 37 back to the dynamo. In operation assume the doors to be all closed, in which case there will be no interruption to the current and the coils 17 and 36 will be energized, attracting the ends of the levers 14 and 35 respectively, and causing the valves to assume the positions shown in Fig. 2, whereupon the pressure will be exerted on the bottom of the piston 4 by reason of the port 12 placing the supply pipe 9 into communication with the pipe 7, thereby opening the gate valve 2 and allowing the hoisting mechanism to be operated; at the same time the fluid on top of the piston 4 has been exhausted through the pipe 6, ports 11 and 10 into the atmosphere, or in case water is used may be conveyed off through suitable piping. Simultaneous with this operation a similar one is occurring in the other valve. The magnet 36 having attracted the lever 35, which throws the ports in the valve stem 29 in a position reverse to those in the valve 8, thus allowing the pressure to come in on top of the piston 19 and by this means release the band brake 23.

When any one of the doors are opened the circuit is broken by reason of the plug 37 leaving the contacts 38, the magnets 17 and 36 are thus deënergized and the weights 45 on the ends of the levers 14 and 35 reverse the levers 13 and 34 to the positions as shown in Fig. 1, whereupon the reverse movement is imparted to the pistons and the gate valve 2 is closed and the brake applied to the pulley 25, thereby preventing any possibility of the car being moved unintentionally or drifting as is often the case while the door is open.

The switch 43 located in the car B may be used by the operator for stopping the car should control be lost at any time, it being obvious that the operation will be the same as if the circuit was broken at any other point.

Slight changes and alterations might be resorted to in the form and arrangement of the several parts described without departing from the spirit and scope of my invention, hence I do not desire to limit myself to the exact construction as herein set forth, but—

Having fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A device of the character described, comprising a pair of cylinders, a pair of piston rods, pistons carried thereby, and reciprocable within the cylinders, a pair of valves having a plurality of ports provided therein, means connecting the valves with the cylinders, a storage supply tank, means connecting the tank with the said valves, a main supply pipe, a gate valve interposed therein, the valve stem provided on the gate valve forming the piston rod within one of the aforesaid cylinders, a lever pivotally supported and connected at one end with the other aforesaid piston rod, a rotatable drum, a band secured around the drum and to the said lever at a point intermediate of its ends, means for operating the said valves whereby the pistons are reciprocated within the said cylinders, thereby closing the said gate valve and simultaneously stopping the rotation of the said drum, substantially as described.

2. A device of the character described, comprising a pair of cylinders, a pair of piston rods, pistons carried thereby and reciprocable within the said cylinders, a supply pipe, a gate valve carried on one end of one of the said piston rods and interposed in the said supply pipe, the said piston rod forming the valve stem of the said gate valve, a revoluble drum, a lever, a band extended around the drum and secured to the said lever intermediate of the ends thereof, said lever being connected with the other piston rod, a pair of valves having a plurality of ports provided therein, means connecting the valves with the said cylinders, a supply tank, means connecting the tank with the said valves, and means for operating the said valves whereby one of the said pistons within one cylinder is made to ascend simultaneously with the descent of the other piston in the other cylinder, substantially as described.

3. A device of the character described, comprising a pair of cylinders, a pair of piston rods, pistons carried thereby and reciprocable within the said cylinders, a supply pipe, a gate valve interposed therein, the valve stem of which is formed on the free end of one of the said piston rods, a revoluble, drum, a band secured around the said drum, a lever connected intermediate of its ends with the said band, the lever being connected to the free end of the other piston rod, a pair of valves, having valve stems within the valves, and a plurality of ports provided therein, a supply pipe connecting therewith, pipes connecting the said valves with the said cylinders, levers connected with the said valve stems, additional levers pivotally secured and connected with the first mentioned levers, and means for operating the said levers, thereby opening and closing the said valves, whereby one of the said pistons is made to ascend simultaneously with the descent of the other, substantially as described.

4. A device of the character described, comprising a pair of cylinders, a pair of piston rods, a piston carried by each piston rod and reciprocable within each of the cylinders, a supply pipe, a gate valve interposed therein, a valve stem formed on the free end of one of the said piston rods and reciprocable within the said valve, a revoluble drum, a band secured around the said drum, a lever pivotally secured and connected interme-

diate of its ends with the said band, said lever being connected with the other piston rod, a pair of valves having valve stems with a plurality of ports provided therein, means connecting the valves with the said cylinders, a supply pipe connected with the said valves, levers pivotally secured and connected with the aforesaid valve stems, armatures provided on the free ends of the said levers, magnetic coils, a source of electric current supply, means connecting the said coils with the said source of supply, thereby energizing the said coils and means for deënergizing the said coils, substantially as described.

5. A device of the character described, comprising a pair of valves, having a plurality of ports provided therein, a pair of cylinders, means connecting the valves with the cylinders, piston rods secured within the cylinders, pistons carried thereby, and reciprocable within the cylinders, a storage tank, means connecting the tank with the said valves, a main supply pipe, a gate valve interposed therein, the valve stem provided on the gate valve forming the piston rod within one of the aforesaid cylinders, a rotatable drum, means connecting the drum with the piston rod within the remaining cylinder, and means for operating the said valves whereby one of the said pistons is made to ascend simultaneously with the descent of the other, thereby closing the said gate valve and simultaneously stopping the rotation of the said drum, substantially as described.

6. A device of the character described, comprising a pair of valves, having a plurality of ports provided therein, a pair of cylinders, means connecting the valves with the cylinders, piston rods secured within the cylinders, pistons carried thereby, and reciprocable within the cylinders, a storage supply tank, a main supply pipe connected therewith, means connecting the said tank with the said valves, a gate valve interposed in the said supply pipe, a rotatable drum, means connecting the said gate valve and drum respectively with one of the piston rods in each respective cylinder, levers provided on the said valves, armatures provided on the said levers, magnetic coils, means energizing the said coils, whereby the said armatures on the said levers are attracted thereto, thereby closing the said gate valve and simultaneously stopping the rotation of the said drum, substantially as described.

7. A device of the character described, comprising a pair of valves, having a plurality of ports provided therein, a pair of cylinders, means connecting the valves with the cylinders, piston rods secured within the cylinders, pistons carried thereby, and reciprocable within the cylinders, a storage supply tank, a supply pipe connected therewith, a gate valve interposed in the said supply pipe; pipes connecting the said tank with the said valves, a rotatable drum, means connecting the said gate valve and drum respectively with one of the said piston rods in each respective cylinder, levers provided on the said valves, armatures provided on the said levers, magnetic coils, means connecting the said coils with a source of electric supply, whereby the said coils are energized and thereby attract the said armatures on the said levers, means for deënergizing the said coils whereby the said armatures are released from the said coils, whereby the said gate valve is closed and opened respectively, thereby permitting the rotating and stopping of the said drum simultaneously with the opening and closing of the said gate valve, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

LOUIS J. MILKE.

Witnesses:
E. Walton Brewington,
Mary M. Magraw.

H. M. ABERNETHY.

FRICTION CLUTCH ELECTRIC CONTROL.

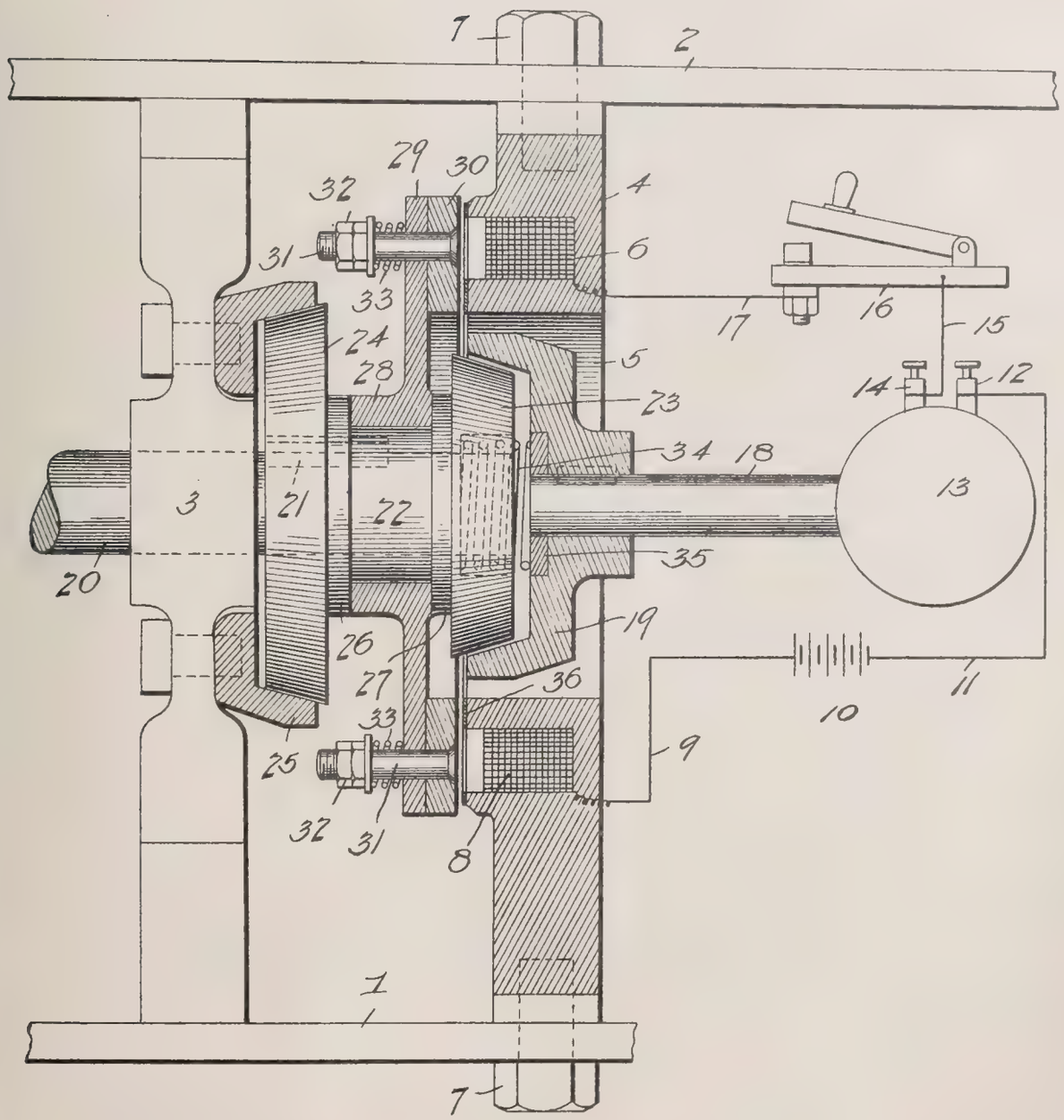
APPLICATION FILED APR. 3, 1908.

936,284.

Patented Oct. 12, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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By Jas. L. Skidmore

His Attorney.

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FRICTION CLUTCH ELECTRIC CONTROL.

APPLICATION FILED APR. 3, 1908.

936,284. Patented Oct. 12, 1909.

2 SHEETS—SHEET 2.

Fig. 2

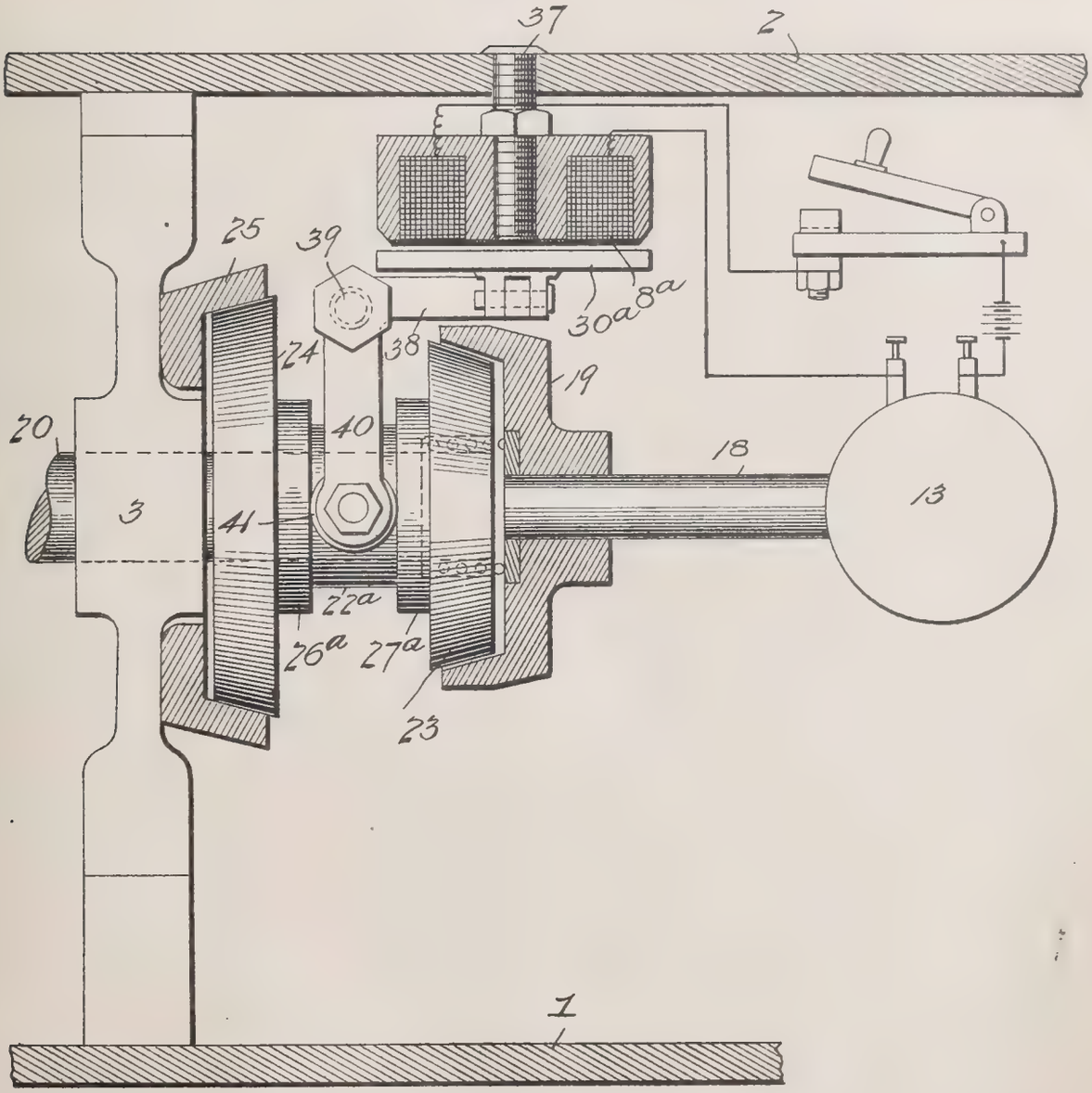
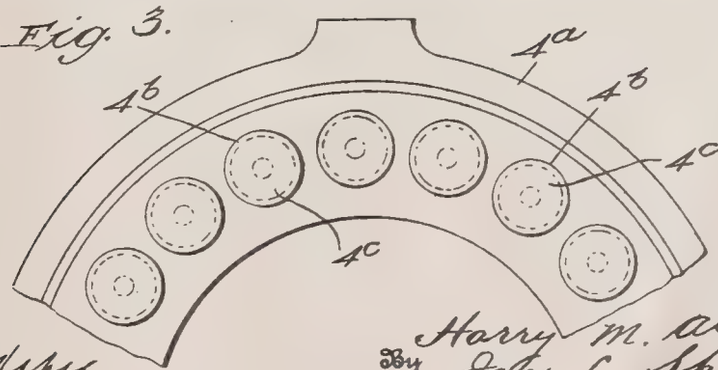


Fig. 3.



Witnesses

T. L. Montague

F. D. McCleary.

Inventor,

Harry M. Abernethy

By Jake L. Stichmore

his Attorney,

ANDREW B. GRAHAM CO., PHOTO-LITHOGRAPHERS WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HARRY M. ABERNETHY, OF CLEVELAND, OHIO.

FRICTION-CLUTCH ELECTRIC CONTROL.

936,284. Specification of Letters Patent. Patented Oct. 12, 1909.

Application filed April 3, 1908. Serial No. 424,894.

To all whom it may concern:

Be it known that I, HARRY M. ABERNETHY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Friction-Clutch Electric Control, of which the following is a specification.

This invention relates to electrically operated friction clutches, and its primary object is, to provide a clutch of simple and effective construction in which a non-revoluble armature is employed in coöperation with a stationary magnet.

A further object of the invention is to provide a clutch comprising coacting friction cones, for revolubly connecting two longitudinally alined shafts, and a brake device for arresting the revolution of one of said shafts.

The construction of the improved friction clutch will be fully described hereinafter in connection with the accompanying drawings which form a part of this specification, and its features of novelty will be set forth in the appended claims.

In the drawing—Figure 1 is a view partly in side elevation and partly in vertical section, of an electrically-controlled friction clutch embodying the invention. Fig. 2 is a similar view of a modified construction of the clutch, and Fig. 3 is a detail view illustrating a further modification.

Referring to Fig. 1 the reference numerals 1 and 2 designate parallel supports or frame bars, between which are secured a shaft bearing 3, and a frame 4, the latter being formed with a circular opening 5, and an annular recess 6 surrounding the opening 5. The frame 4 is secured to the parallel supports 1 and 2 by bolts 7. A magnet coil 8 is arranged within the annular recess 6 of the frame 4, said coil being connected by a wire conductor 9 with one pole of a battery 10, the opposite pole of which is connected by a wire 11, to a binding post 12 of an electric motor 13. From another binding-post 14 of the motor a wire 15 leads to a switch 16, connected by a conductor 17 to the coil 8. The reference numeral 18 designates the shaft of the motor extending into the opening 5 of the frame and having keyed thereto a cone-shaped clutch member 19. Supported in the bearing 3 is a shaft 20 alined longitudinally with the motor shaft 18, and having secured thereto by a spline 21 a sleeve 22 provided at one end with a conical clutch member 23 adapted to fit within and frictionally engage the clutch member 19. At the opposite end of the sleeve 22 is another integral conical disk 24 adapted to fit within and frictionally engage a conical or cup-shaped ring 25 bolted to the bearing 3. The sleeve 22 is also provided with collars 26 and 27 between which is arranged a non-revoluble support consisting of a hub 28 through which the sleeve 22 extends, and an annular flange 29 to which is secured a ring armature 30 by means of bolts 31 and lock nuts 32, coil springs 33, being interposed between the flange 29 and the nuts to afford yielding connections for the armature. A coil spring 34 is also interposed between the clutch members 19 and 23, the latter being recessed to receive one end of said spring, and the member 19 being countersunk to receive a ring 35 fitting over the end of the motor shaft 18 the spring bearing against said ring. The function of this spring 34 is to retract the clutch member 23 and release it from the member 19 when the magnet coil 8 is deënergized.

The utility and operation of the clutch constructed as thus described will be readily understood. When the switch 16 is closed a circuit is completed from the battery through the magnet coil 8, and the latter attracts the armature 30 causing the non-revoluble supports 28 and 29 to move carrying with it the sleeve 22 and conical members 23 and 24. The clutch member 23 is thus forced into frictional engagement with the member 19, so that the shaft 20 will revolve with the motor shaft 18. When the magnet coil is deenergized by opening the switch 16 the spring 35 forces the clutch members 19 and 23 apart and forces the conical disk 24 into frictional engagement with the stationary conical member 25 said members 24 and 25 serving as a brake to arrest the motion of the shaft 20.

To prevent the magnetization of the armature 30, and its tendency to "stick" after the magnet coil has been deënergized I provide a thin washer 36 of copper or other suitable non-magnetic material covering the contact surface of the frame 4.

A distinguishing characteristic of the present invention is, that as both the magnet coil and armature are non-revoluble there will be no cutting of the lines of force between the magnet and armature to produce rotary motion, and hence the full and direct

strength of the current is utilized in the attraction of the armature.

In Fig. 2 I have shown a modified embodiment of the invention in which the shafts 18 and 20, and elements carried thereby are substantially similar to those shown in Fig. 1. In this modification, however, the magnet frame 4 and the armature support 28, 29 are omitted. The magnet 8^a is suspended from the frame 2 by means of a screw 37. The armature 30^a is carried by a bell crank lever 38 pivotally secured at the point 39 and having its depending portion 40 bifurcated to straddle the sleeve 22^a. The lower ends of the forked arms of the lever 38 carry antifriction roller 41 which bear against the collars 26^a and 27^a of the sleeve. The operation of this modified form of the clutch will be obvious from the drawing in connection with the foregoing explanation.

In Fig. 3 is shown a further modification in which a magnet frame 4^a is employed provided with a series of circular recesses 4^b within each of which is fitted a magnet coil 4^c, said coils being employed in lieu of the single magnet coils shown in the other figures and being connected in series to a battery.

I would have it understood that the invention includes all such further modifications and variations in the details of construction as may fall within the terms and scope of the following claims.

Having thus described the invention what I desire to secure by Letters Patent and claim is:—

1. An electrically-operated friction clutch, comprising a clutch member mounted upon a revoluble shaft, a stationary magnet coil surrounding said clutch member, a second clutch member, mounted upon an independent shaft longitudinally alined with said revoluble shaft, and a non-revoluble armature surrounding said independent shaft and adapted to be attracted by said magnet coil.

2. An electrically-operated friction clutch comprising a conical member mounted upon a motor shaft, a stationary magnet coil surrounding said clutch member, a second conical clutch member mounted upon an independent shaft in longitudinal alinement with said motor shaft, a non-revoluble support provided with a central opening through which said independent shaft extends, an armature carried by said support and means carried by said independent shaft for causing said second clutch member to be moved when said armature is attracted by said magnet coil.

3. An electrically-operated friction clutch comprising a stationary frame provided with an opening, a magnet coil supported by said frame, a motor shaft extending within said opening, a conical clutch member mounted upon said motor shaft, a shaft bearing adjacent to said frame, a second shaft mounted in said bearing, a second conical clutch member mounted upon said shaft, a non-revoluble support having a central opening through which said second shaft extends, an armature carried by said support, and a sleeve upon said second shaft having collars on opposite sides of said support.

4. An electrically-operated clutch, comprising a stationary frame provided with an opening, and an annular recess, a magnet coil within said recess, a motor shaft extending within said opening, a conical clutch member mounted upon said motor shaft, a shaft bearing parallel with said frame, a second shaft within said bearing, a conical clutch member upon said shaft, a non-revoluble armature support having a central opening through which said second shaft extends, a sleeve provided with collars upon said second shaft, an armature carried by said support, means for retracting said longitudinally-movable shaft, and means for arresting its revolution.

5. An electrically-operated clutch, comprising a stationary frame provided with an opening, and an annular recess, a magnet coil within said recess, a motor shaft extending within said opening, a conical clutch member mounted upon said motor shaft, a shaft bearing parallel with said frame, a second shaft within said bearing, a conical clutch member upon said shaft, a non-revoluble armature support having a central opening through which said second shaft extends, a sleeve provided with collars upon said second shaft, an armature carried by said support, means for retracting said longitudinally-movable shaft, and means for arresting its revolution comprising coöperating conical brake members.

6. An electrically-operated friction clutch comprising a stationary frame provided with an opening, a magnet coil carried by said frame, a motor shaft extending within said opening, a conical clutch member mounted upon said shaft, a bearing adjacent to said frame, a second shaft within said bearing, a clutch member mounted on said second shaft, a non-revoluble support having a central opening through which said second shaft extends, an armature yieldingly-secured to said support, a sleeve upon said second shaft having collars on opposite sides of said support, a coil spring interposed between said clutch members and a brake consisting of cooperating conical members one carried by said shaft, and the other secured to said shaft bearing.

HARRY M. ABERNETHY.

Witnesses:
F. O. McCLEARY,
MAY M. PLYER.

J. T. ALBERT.

SAFETY APPLIANCE FOR ELEVATORS.

APPLICATION FILED SEPT. 2, 1908.

936,285. Patented Oct. 12, 1909.

Fig. 1.

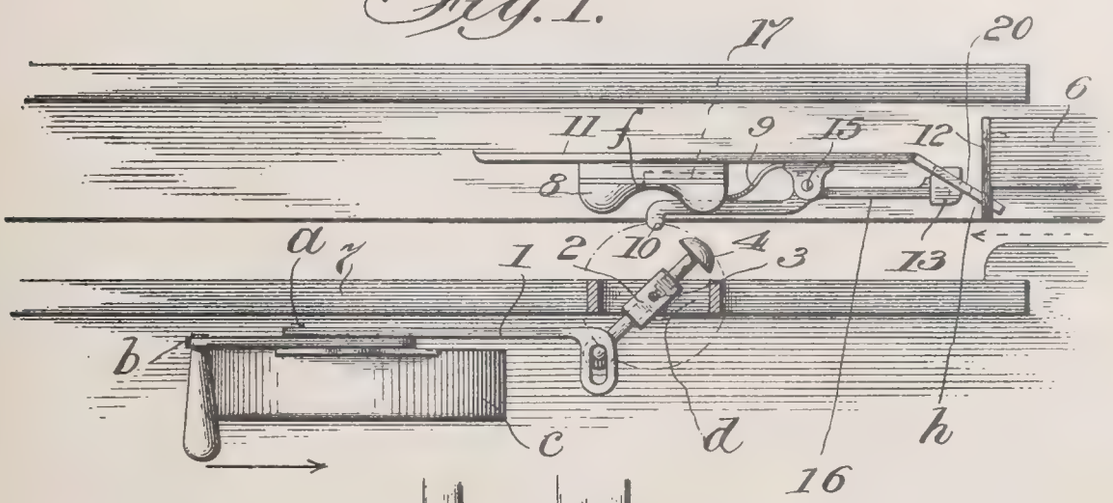
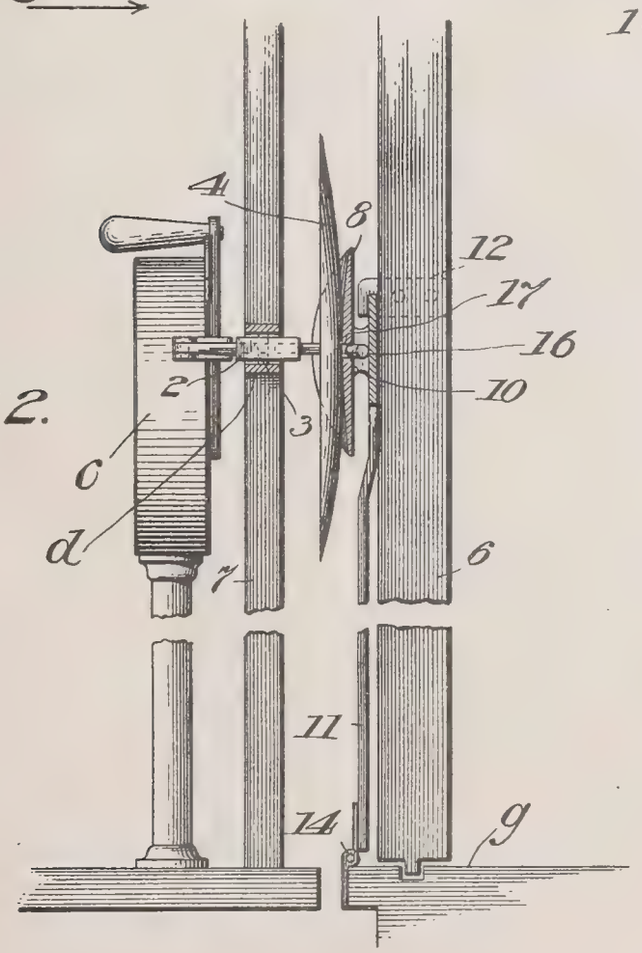


Fig. 2.



Witnesses:

H. Findlay French

Alberta Richards

Inventor:

Joseph Taylor Albert,

by G. H. W. T. Howard,

Atty.

ANDREW B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOSEPH TAYLOR ALBERT, OF BALTIMORE, MARYLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE UNIVERSAL SAFETY ELEVATOR LOCKING DEVICE CO., A CORPORATION OF MARYLAND.

SAFETY APPLIANCE FOR ELEVATORS.

936,285. Specification of Letters Patent. Patented Oct. 12, 1909.

Application filed September 2, 1908. Serial No. 451,435.

To all whom it may concern:

Be it known that I, JOSEPH TAYLOR ALBERT, of the city of Baltimore and State of Maryland, have invented certain Improvements in Safety Appliances for Elevators, of which the following is a specification.

In the description of the said invention which follows, reference is made to the accompanying drawing forming a part hereof, and in which,—

Figure 1 is a horizontal section of certain parts of the elevator cage, together with the sliding door on one of the floors of the building, illustrating the relative positions of the said parts when the sliding door is closed and locked. Fig. 2 is a vertical side of certain parts of the apparatus, shown in Fig. 1, some of which are represented in section, and illustrating the relative positions of the various parts when the motive power is cut off, and the sliding door open.

Referring now to the drawing, 1 is a bar pivoted at *a* to the handle *b* of the controller *c* situated within the cage, whereby the cage is put in motion, or stopped.

The outer end of the bar 1 is pivoted to a tumbler 2 which is centrally fulcrumed at 3 within a box *d* let into the wall 7 of the cage. The free end of the tumbler 2 is provided with a vertically tapered head 4 having a laterally rounded outer surface.

In the movement of the controller handle *b* in the direction indicated by the full arrow in Fig. 1, to the vertical position shown in Fig. 2, power to move the cage is cut off, and the tumbler 2 brought to a right angle with respect to the wall 7 of the cage and its head 4 directly in front of a central depression *f* in the block 8, adapted to receive the said head. The block 8 is secured to a plate 11 hinged at 14 to the floor *g* of the building, and adapted to be swung toward and from the wall 7 of the cage. In Fig. 1 the plate 11 is shown in its extreme backward, and in Fig. 2 in its extreme forward position.

The edge of the plate 11, to the right of Fig. 1, has an angular or inclined extension *h*, which passes through a slot in the plate 12 fastened to the edge of the sliding door 6 a portion only of which door is shown. The door 6 has to be slid in the direction indicated by the dotted arrow to give entrance to the cage.

16 is a locking lever pivoted at 15 to the plate 11. The inner arm of the said lever rests in a slot 17 (shown in full lines in Fig. 2) in the block 8, and is provided at its end with a finger 10 which is shown in both figures of the drawing. The outer arm of the locking lever 16 passes through a slot 20 (shown in dotted lines in Fig. 1) in the angular extension *h* of the vertical hinged plate 11, where it is provided with a stop 13 which, when the sliding door 6 is closed as shown in Fig. 1, is opposed to the edge of the said door, and locks the same and prevents its being opened. The locking lever 16 is yieldingly held in position, by means of a spring 9.

Supposing the various parts of the apparatus to be in the relative positions shown in Fig. 1, it will be seen that the cage can be elevated or lowered, but the sliding door being locked by the stop 13 of the locking lever 16, cannot be opened; but should the motive power be cut off by changing the handle *b* of the controller *c* from the horizontal position shown in Fig. 1 to the vertical position illustrated in Fig. 2, the tumbler 2 will be turned and brought to a right angle with respect to the wall 7 of the cage, and its head 4 brought opposite to or in vertical alinement with the depression *f* in the block 8 on the hinged vertical plate 11. As the cage 7 in moving upward or downward reaches any floor of the building having a sliding door provided with the elements of the safety appliances described, and the motive power shut off, the tapered head 4 of the tumbler 2 will engage the finger 10 of the locking lever 16, but not communicate such movement to the lever as to affect or interfere with its locking function. In opening the sliding door 6 to give entrance to the cage, the slotted plate 12 first traverses the angular extension 20 of the vertical hinged plate 11, and by the time that it has reached the straight or main portion of that device, the plate 11 will have been thrown forward carrying with it the block 8, and the locking lever 16. The finger 10 of the locking lever being in contact with the head 4 of the tumbler 2, the said lever does not receive a motion in common with the vertical hinged plate 11 and its block 8 but is tilted and its stop 13 removed from the path of the sliding door 6, and therefore that device does not offer any obstacle to the full

and complete opening of the door, or the closing of the same.

It will be understood that in the opening of the sliding door as described, the head 4 of the tumbler 2 enters the depression *f* of the block 8, consequently the handle *b* of the controller *c* cannot be restored to its original position and the cage set in motion, until the door has been closed in which operation the hinged plate 11 is restored to its original position or that shown in Fig. 1 and the stop 13 of the locking lever 16 is again brought into locking position.

I claim as my invention,

1. An elevator cage, a motion controller situated within the cage having an operating handle, a tumbler fulcrumed in the wall of the cage and adapted to extend outwardly therefrom, a device to actuate the tumbler from the handle of the controller, a vertical hinged plate situated exteriorly of the cage, having a fixed position, a sliding door on a floor of the building, and locking mechanism for the tumbler, and a stop for the sliding door both of which are carried by the hinged plate, combined with an appliance attached to the sliding door which in the opening of the door, throws the sliding plate and the locking and stop mechanism toward the cage, whereby the former cooperates with the tumbler to lock the controller and the latter is moved from the path of the sliding door, substantially as specified.

2. An elevator cage, a motion controller situated within the cage having an operating handle, a tumbler fulcrumed in the wall of the cage, a device to actuate the tumbler from the operating handle of the controller, and a sliding door placed exteriorly of the cage, combined with a vertical hinged plate having a fixed position, an appliance secured to the sliding door whereby in the opening and closing of the same, the vertical plate is made to move toward and from the cage, and stop mechanism carried by the said plate adapted to coöperate with the tumbler as the motive power is cut off, and thereby render the stop mechanism inoperative in the initial movement of the door in the opening operation, substantially as specified.

3. An elevator cage, a motion controller situated within the cage having an operating handle, a tumbler pivoted in the wall of the cage with its outer end projecting outwardly therefrom, and a bar which connects the operating handle with the inner end of the tumbler, the arrangement of the said parts being such that upon the stoppage of the cage, the outward projection of the tumbler is increased, combined with a hinged vertical plate having a fixed position and susceptible of a swinging movement toward and from the wall of the cage, a block secured to the hinged plate having a depression therein adapted to receive the projecting end of the tumbler and thereby prevent its movement, and that of the controller handle, means to effect the swinging movement of the vertical plate carrying the recessed block primarily derived from the sliding door, and a locking lever having a stop for the door, which receives its unlocking motion through the medium of the tumbler in the swinging movement of the vertical hinged plate, substantially as specified.

JOSEPH TAYLOR ALBERT.

Witnesses:
CHAS. C. EYLER,
JOHN H. HENKUS.

J. S. MUCKLÉ.

ELEVATOR.

APPLICATION FILED APR. 21, 1909.

938,268.

Patented Oct. 26, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

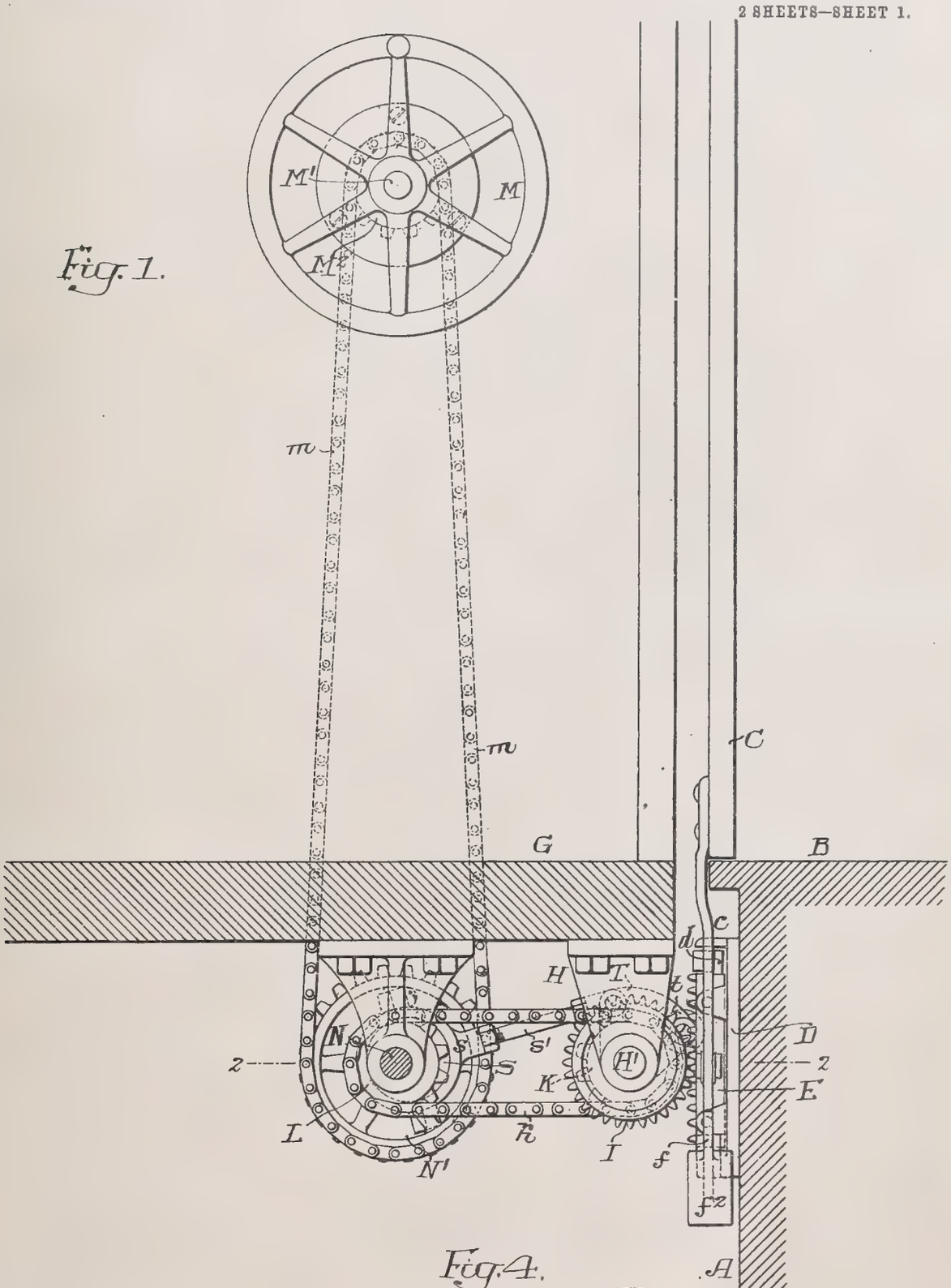
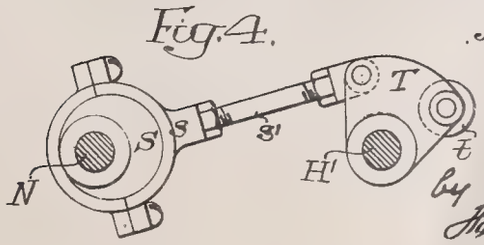


Fig. 4.



Witnesses:
R. L. Stevens
E. W. Fowler

Inventor:
John S. Muckle
by his Attorneys—
Howson & Howson

ANDREW B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

J. S. MUCKLÉ.

ELEVATOR.

APPLICATION FILED APR. 21, 1909.

938,268.

Patented Oct. 26, 1909.

2 SHEETS—SHEET 2.

Fig. 2.

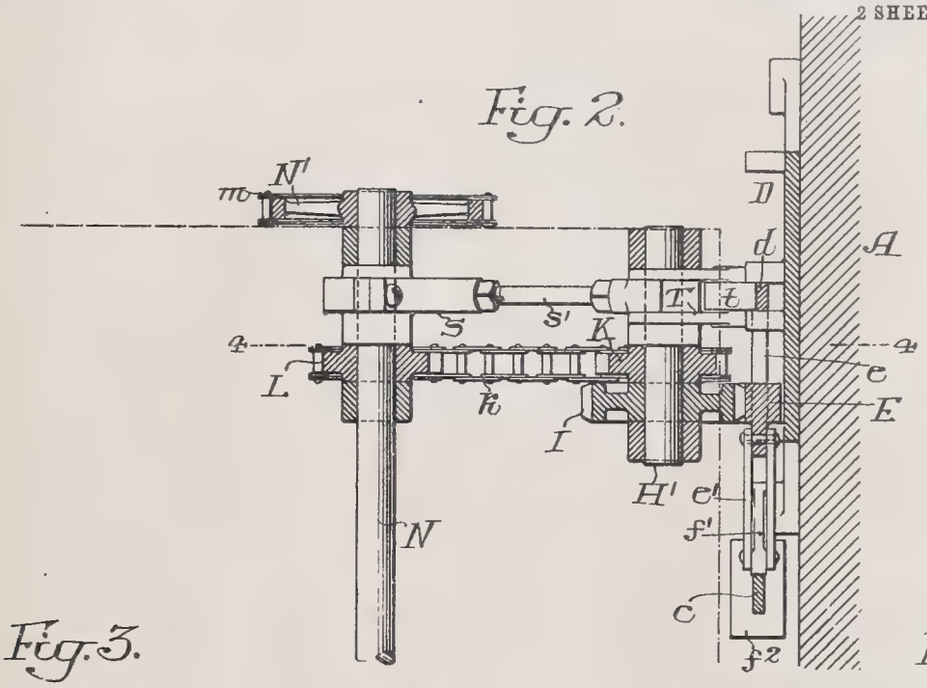


Fig. 3.

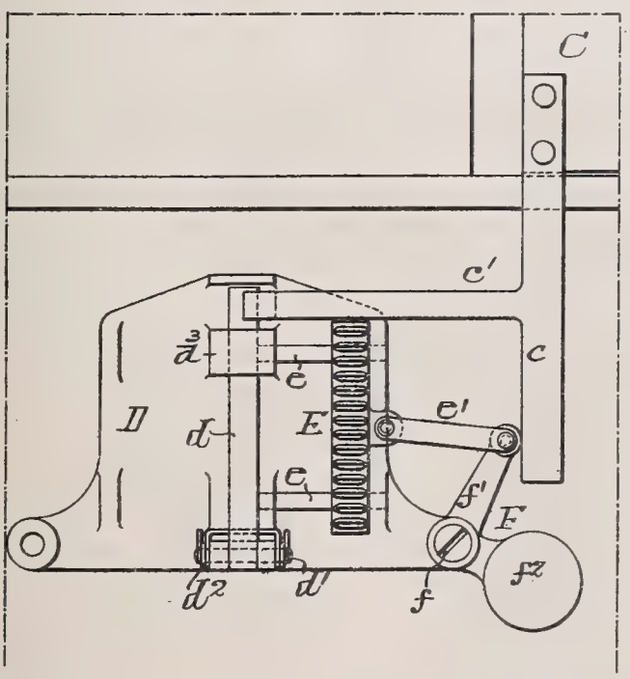


Fig 5.

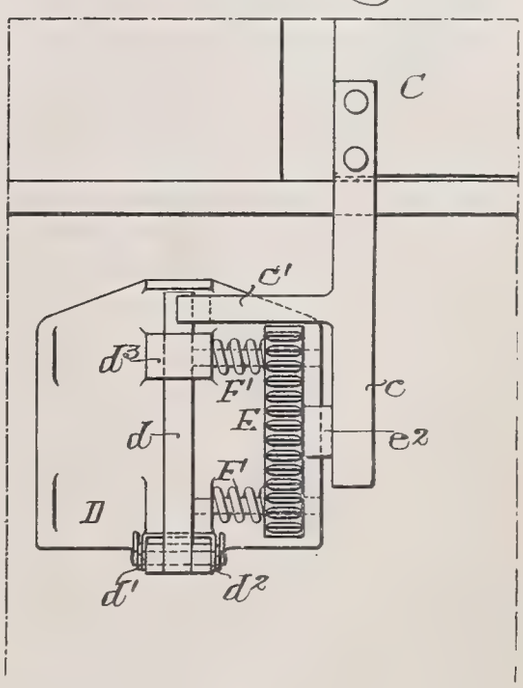
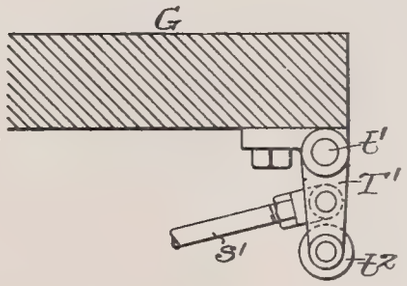


Fig. 6.



Witnesses
R. L. Stevens
C. W. Fowler

Inventor:
John S. Muckle
by his Attorneys—
Howson & Howson

UNITED STATES PATENT OFFICE.

JOHN S. MUCKLÉ, OF PHILADELPHIA, PENNSYLVANIA.

ELEVATOR.

938,268. Specification of Letters Patent. Patented Oct. 26, 1909.

Application filed April 21, 1909. Serial No. 491,269.

To all whom it may concern:

Be it known that I, JOHN S. MUCKLÉ, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Elevators, of which the following is a specification.

My invention relates to certain improvements in mechanism for preventing the opening of the landing doors of an elevator when the car is not at the landing, and preventing the starting of the car when at a landing when the door is open.

The object of my invention is to provide means for bringing the floor of the car to a level with the floor of the landing in case of leakage, which would ordinarily allow the car to either gradually sink below the level of the landing floor or rise above it. This object I attain in the following manner, reference being had to the accompanying drawings, in which:

Figure 1, is a sectional view of sufficient of the car and the landing to illustrate my invention; Fig. 2, is a sectional plan view on the line 2—2 Fig. 1; Fig. 3, is a view showing the mechanism on the wall of the elevator well; Fig. 4, is a sectional view on the line 4—4, Fig. 2; Fig. 5, is a view of a modification of the device illustrated in Fig. 3; and Fig. 6, is a view of a modification of the mechanism for releasing the door.

A is the wall of the elevator well, B is a landing floor, C is the landing door having an arm c which extends into the path of the mechanism secured to the wall of the elevator well, and c' is a latch extension of this arm with which the latch d engages. This latch d is pivoted at d' to the frame D secured to the wall of the elevator well, and has a spring d^2 tending to force it out against the yoke d^3.

The end of the extension c' of the arm c is beveled and hooked, so that it will engage the latch d and thus lock the door in its closed position. When the latch d is pushed back by the mechanism on the car, it releases the door and allows it to be opened.

A rack E is adapted to slide on rods e—e, mounted on the frame D. The teeth of the rack E are beveled at one or both ends, as clearly illustrated in the drawing, Fig. 3. The rack is normally held in the position shown in Fig. 3 by a weighted lever F pivoted at f, having an arm f' connected by a link e' to the rack E, and having a weight f^2 of sufficient size to return the rack to its normal position as soon as released from the control of the door. It will be noticed that the arm f' of the lever F is in the path of the extension of the arm c depending from the door. A roller may be provided on the arm f' if found necessary.

When the door is closed the arm c of the door will hold the rack out of line with the pinion on the car, and the door will be held closed by the latch d and as soon as the latch is actuated and the door partially opened, for instance as shown in Fig. 3, the weight f^2 will remove the rack to the position shown in said figure and in line with a pinion on the car. In place of the weight, I may use springs F′ mounted on the rods e, the arm c on the door contacting with a projection e^2 on the rack E, Fig. 5.

Mounted on the under side of the car G is a bearing H, for a shaft H′ on which is mounted a pinion I and a sprocket wheel K. The teeth of the pinion are arranged to mesh with the teeth of the rack E, and when the rack is in the position shown in Figs. 2 and 3, the teeth of the rack are in engagement with the teeth of the pinion, consequently any movement up or down of the car G will cause the pinion I to turn, and as the sprocket wheel is connected to the pinion it must turn with it. A chain k passes around the sprocket wheel K, and around a sprocket wheel L on a shaft N, on which is a sprocket wheel N′.

M is the hand wheel within the car, mounted on a shaft M′, which passes through the side of the car, and on the shaft is a sprocket wheel M^2. A chain m passes around the sprocket wheel M^2 and around the sprocket wheel N′ on the shaft N. The shaft N is connected to the valve operating mechanism of the elevator in the ordinary manner, so that any movement of the shaft N will so operate the mechanism as to stop the car or move it either up or down, so that when the mechanism is in gear with the rack E on the wall of the elevator well if the elevator should gradually drop from the position in line with the floor of the landing, it will immediately operate the controlling mechanism, so as to bring the car back to a point on a line with the landing.

On the shaft N is an eccentric S, having a strap s connected by a rod s' to a lever T loose on the shaft H′ in the present instance, and on this lever is a roller t which, when the car is in the position illustrated

in Fig. 1, is in line with the latch *d* on the elevator well, as illustrated in Fig. 2, so that when the hand wheel M is turned by the operator to stop the car when the car is at the landing, the eccentric is so adjusted on its shaft that it will project the lever T, bringing its roller in contact with the latch, pressing the latch and releasing the door, after which the door can be opened by the operator and this will immediately release the rack E and its lever or spring will move it into mesh with the pinion I on the car.

The teeth of the rack, as well as the teeth on the pinion, are preferably beveled at one or both ends so as to insure the meshing of the rack with the pinion, and in place of the lever T a lever T′ pivoted at *t′* may be used carrying a roller t^2 as illustrated in Fig. 6.

When the rack is in mesh with the pinion, it cannot be thrown out of gear until it is moved bodily to one side, as the rack is held rigidly in position against any movement of the car or its pinion. Any movement of the car when the car is at the landing must be transmitted to the valve mechanism, so as to bring the car at or about the level of the landing.

I claim:

1. The combination in interlocking mechanism for elevators of a landing, a door at the landing, a car, controlling mechanism for the car, a pinion on the car geared to the controlling mechanism, means on the wall of the elevator well including a latch and a rack movable parallel to the axis of the pinion, said rack being automatically moved into gear with the pinion when the landing door is open and moved to one side of the gear when the landing door is closed.

2. The combination of a landing, a landing door, a latch pivoted to the wall of the elevator well, guides on the wall of the elevator well, a rack adapted to slide on said guides, a car, latch operating mechanism on the car, controlling mechanism, and a pinion on the car connected with the controlling mechanism of the car, means for holding the rack in the path of the pinion on the car, means on the door for holding the rack out of the path of the pinion on the car when the door is closed, and means on the door for engaging the latch.

3. The combination of a landing, a landing door, a frame on the wall of the elevator well at the landing, a latch pivoted to the frame, transverse guides on the frame, a rack adapted to slide on the said guides, means for normally holding the rack in the path of a gear on the car when the door is opened, and means on the door for holding the rack out of position when the door is closed, and means on the door for engaging the latch, a car, and operating means for actuating the controlling means, a shaft geared to said operating mechanism, an eccentric on the shaft and a sprocket wheel also on the shaft, a second shaft, a pinion on the second shaft adapted to mesh with the rack on the wall of the elevator well, a sprocket wheel on the second shaft, a chain extending from the sprocket wheel on the second shaft, to the sprocket wheel on the main shaft, and a lever on the second shaft connected to the eccentric on the main shaft, said lever adapted to actuate the latch to release the door when the mechanism is operated to bring the car to a standstill at the landing.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

JOHN S. MUCKLÉ.

Witnesses:
HENRY HOWSON,
WM. A. BARR.

T. H. GERRARD.

CLUTCH.

APPLICATION FILED APR. 10, 1908.

940,002. Patented Nov. 16, 1909.

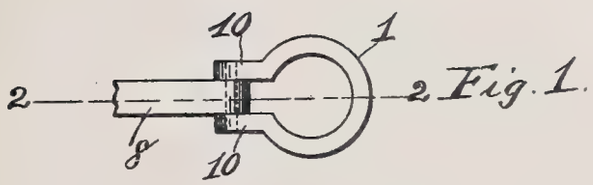


Fig. 1.

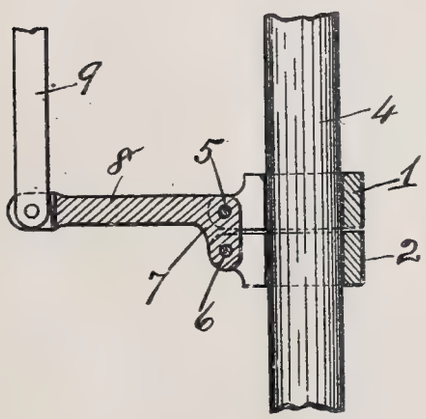


Fig. 2.

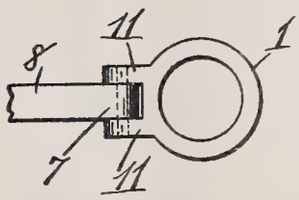


Fig. 3.

Witnesses:
J. Donsbach
G. Manning

Inventor:
Thomas H. Gerrard.
By Mosher & Curtis.
Attys.

ANDREW B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

THOMAS H. GERRARD, OF TROY, NEW YORK, ASSIGNOR OF ONE-HALF TO EDMOND A. MICHON, OF TROY, NEW YORK.

CLUTCH.

940,002. Specification of Letters Patent. **Patented Nov. 16, 1909.**

Application filed April 10, 1908. Serial No. 426,389.

To all whom it may concern:

Be it known that I, THOMAS H. GERRARD, a citizen of the United States, residing at Troy, county of Rensselaer, and State of New York, have invented certain new and useful Improvements in Clutches, of which the following is a specification.

The invention relates to such improvements and consists of the novel construction and combination of parts hereinafter described and subsequently claimed.

Reference may be had to the accompanying drawings, and the reference characters marked thereon, which form a part of this specification.

Similar characters refer to similar parts in the several figures therein.

Figure 1 of the drawings is a top plan view of my improved clutch. Fig. 2 is a vertical section of the same taken on the broken line 2—2 in Fig. 1, showing the clutch applied to a sliding member. Fig. 3 is a top plan view of a modified form of clutch embodying my invention.

The principal object of the invention is to control at certain times the movement of a sliding member.

The invention is applicable to various devices wherein sliding members are employed, and wherein it is desired to control the movements of such a sliding member at certain times, and to permit the same to slide at certain other times.

Referring to the drawings, wherein the invention is shown in preferred form, 1 and 2, are sleeves or rings, each being in the form of either a split sleeve, as shown in Fig. 1, or a closed sleeve, as shown in Fig. 3, in either case being adapted to freely receive a sliding member 4. The sleeves or rings, 1—2, are of substantially the same internal diameter, which is slightly more than the diameter of the sliding member, 4, so that when the two rings or sleeves, 1—2, are held in direct line, one above the other, the sliding member, 4, will be permitted to slip or slide freely through both rings. The clutch members, 1 and 2, are connected by the respective pivots, 5 and 6, with an angle-lever, 7, having an operating arm, 8, said lever being adapted to work in a plane radial to the rings or sleeves 1—2. The operating arm, 8, can be controlled by a link-connection, 9, with any suitable mechanism, or may be operated by hand.

When a lifting force is applied to the operating arm, 8, the clutch-members, 1 and 2, will be forced in opposite directions into engagement with the sliding member, 4, the sleeve, 1, being pushed against one side of the sliding member, while the sleeve, 2, is pulled against the opposite side thereof. When the sleeves, 1—2, are thus forced against the opposite sides of the sliding member, they together grip or clutch said sliding member, and prevent the same from slipping or sliding relatively to the clutch, but, as soon as the lifting force is withdrawn from the operating arm, 8, of the lever, the sliding member, 4, is relieved from the control of the clutch, and permitted to slide downward by gravity.

I do not wish to be limited to any particular use of the clutch above described, as the same is applicable for use in many situations.

In the construction shown in Figs. 1 and 2, each of the split sleeves terminates in a pair of ears, 10, and the lever, 7, is inserted between and pivotally connected with each of said pair of ears.

In the construction shown in Fig. 3, the ears, 11, project from the solid ring or sleeve.

As illustrating certain uses of my invention, the rod 4 may be a carbon in an arc-lamp, and the link-connection 9 may be a link connecting with the armature of an electro-magnet in such arc-lamp, as is fully understood by those skilled in the art; or the rod 4 may be the post or spindle of a lifting jack, and the link 9 a lifting member therefor.

What I claim as new and desire to secure by Letters Patent is—

A clutch for sliding members comprising

a pair of clutch-members located in different horizontal planes and adapted to receive the sliding members and to shearingly engage the opposite sides thereof, an angle-lever having a vertical arm pivotally connected with both of said clutch-members, and a lifting member positively connected directly with a horizontal arm of said lever and constituting the sole support for said lever and said clutch-members.

In testimony whereof, I have hereunto set my hand this 30th day of March, 1908.

THOMAS H. GERRARD.

Witnesses:

FRANK C. CURTIS,

J. DONSBACH.

J. S. MUCKLÉ.

INTERLOCK MECHANISM FOR ELEVATORS.

APPLICATION FILED JULY 19, 1909.

957,702.

Patented May 10, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

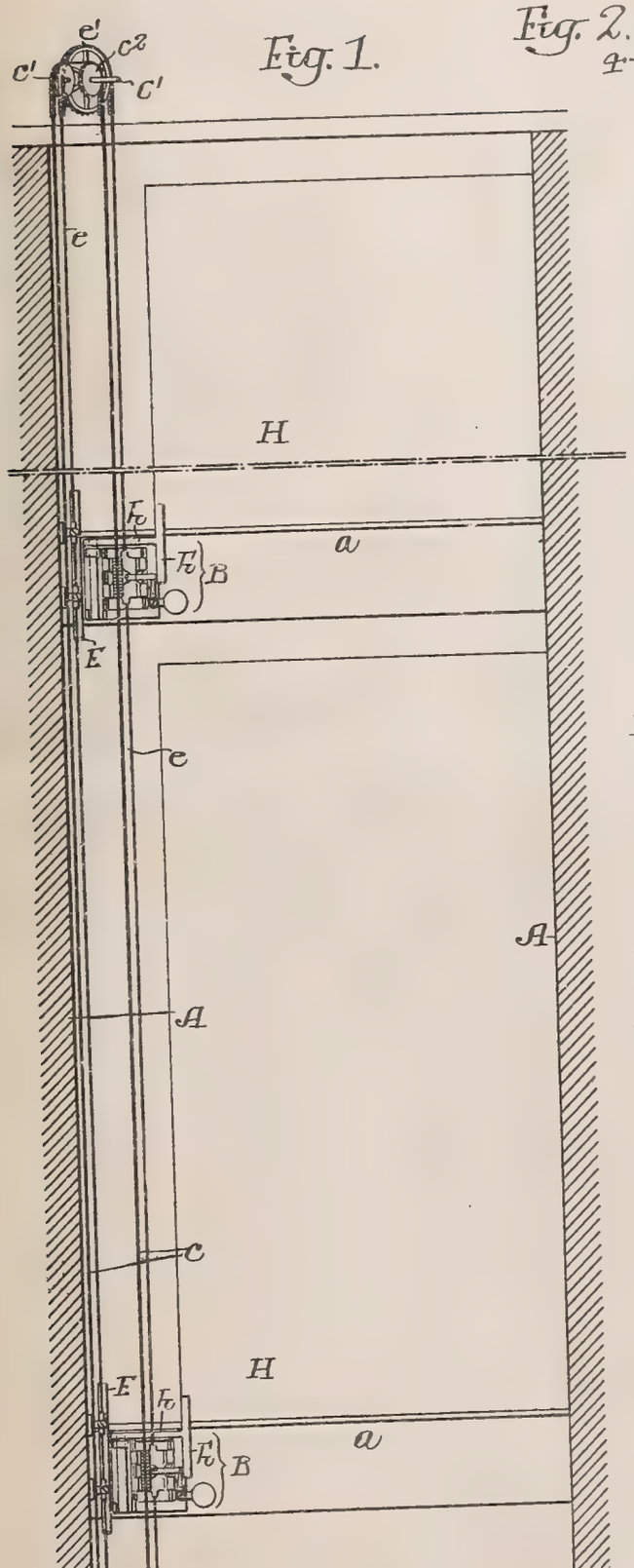


Fig. 2.

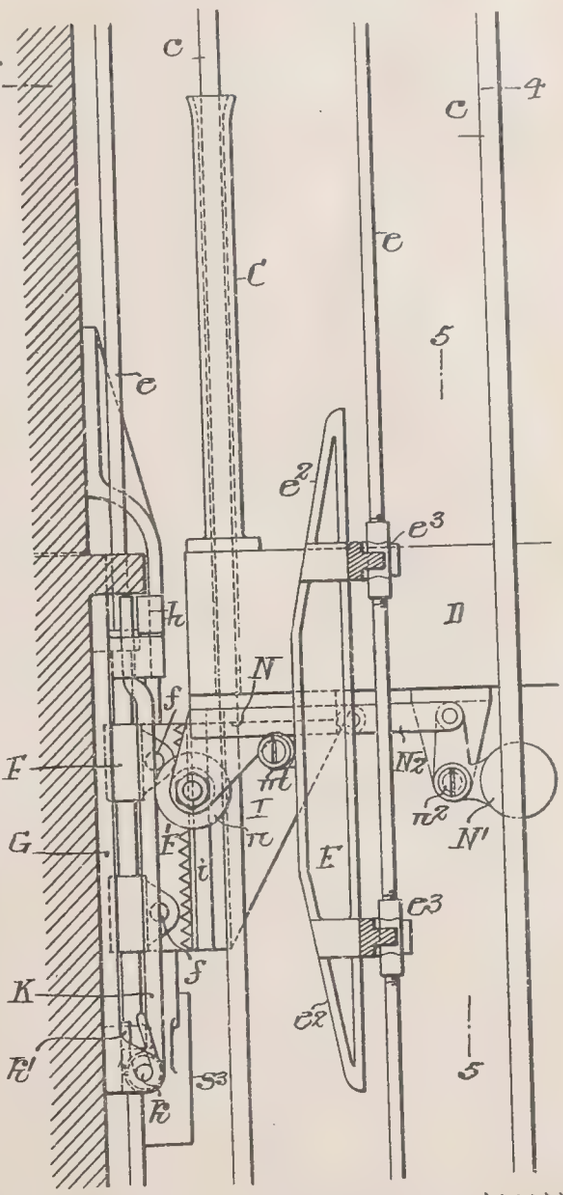
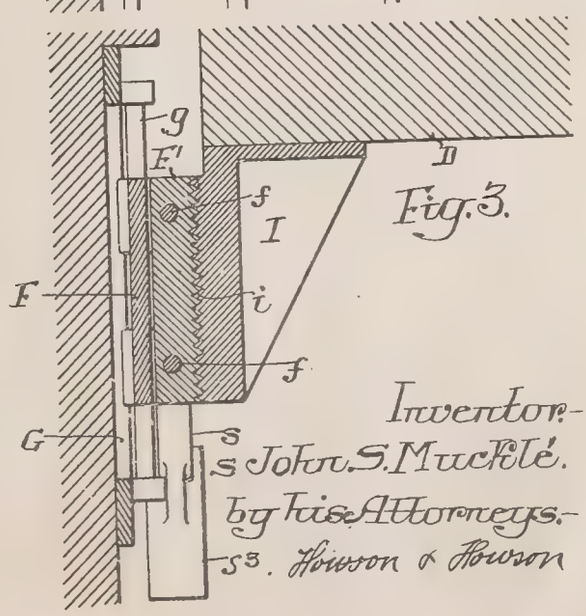


Fig. 3.



Witnesses.-
Wills A. Burrows
Wm a. Bow.

Inventor.-
John S. Muckle.
by his Attorneys.-
Howson & Howson

ANDREW B. GRAHAM CO. PHOTO-LITHO. WASHINGTON, D. C.

J. S. MUCKLÉ.

INTERLOCK MECHANISM FOR ELEVATORS.

APPLICATION FILED JULY 19, 1909.

957,702. Patented May 10, 1910.

2 SHEETS—SHEET 2.

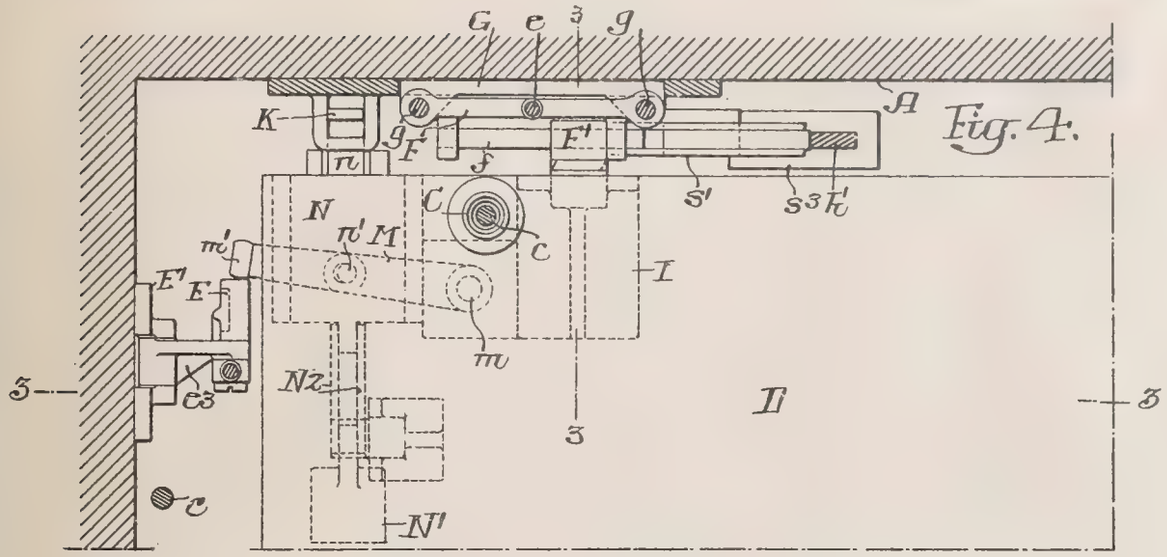


Fig. 4.

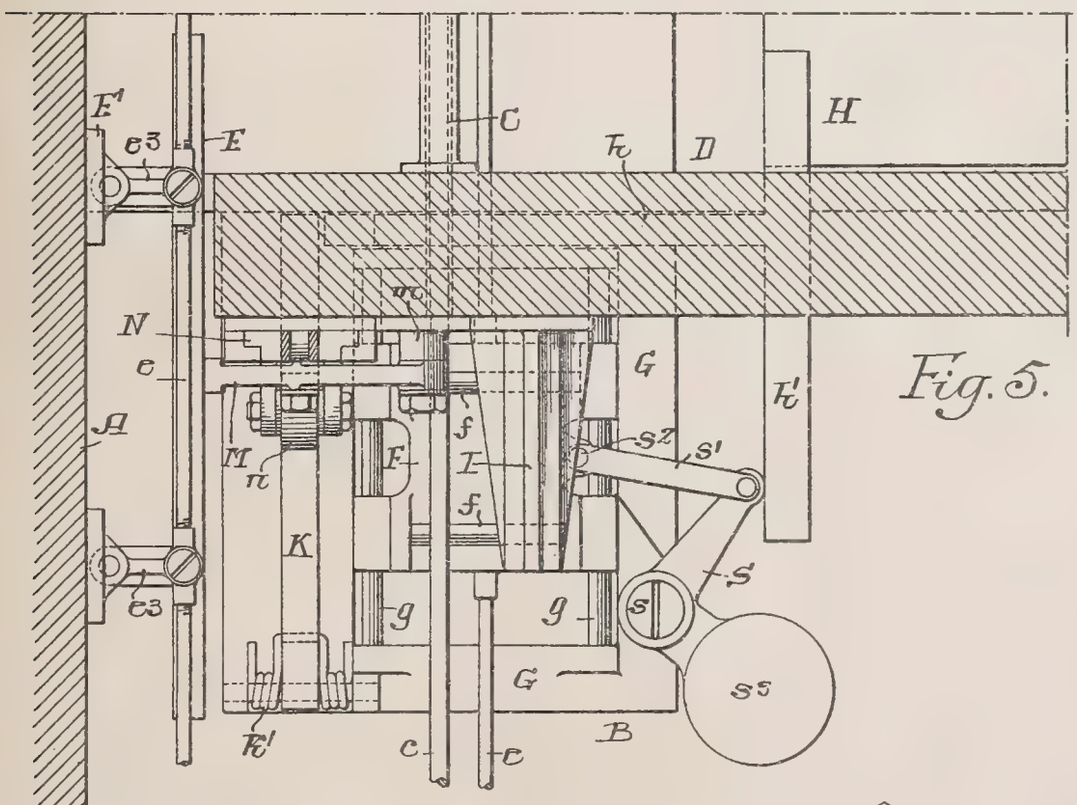


Fig. 5.

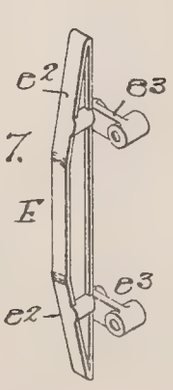


Fig. 7.

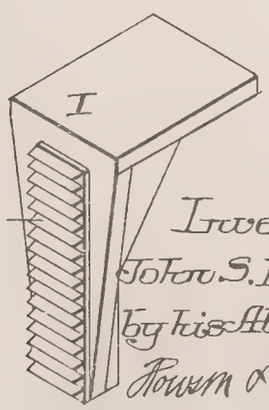


Fig. 6.

Witnesses.-
Wills A. Burrows
Wm a. Baw.

Inventor.-
John S. Mucklé.
by his Attorneys
Bowen & Bowen

ANDREW B. GRAHAM CO. PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN S. MUCKLÉ, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO STANDARD ELEVATOR INTERLOCK COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

INTERLOCK MECHANISM FOR ELEVATORS.

957,702. Specification of Letters Patent. Patented May 10, 1910.

Application filed July 19, 1909. Serial No. 508,421.

To all whom it may concern:

Be it known that I, JOHN S. MUCKLÉ, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Interlock Mechanism for Elevators, of which the following is a specification.

The object of my invention is to construct interlock mechanism for use in elevators of the type in which a hand cable or rope is used to actuate the controlling mechanism for starting and stopping the reversing gear; the mechanism being so constructed that the landing doors cannot be moved from the platform until the door at that particular platform is closed.

In the accompanying drawings:—Figure 1, is a vertical sectional view of an elevator well illustrating my improved mechanism; Fig. 2, is a sectional view through the elevator well and a side view of a portion of the car; Fig. 3, is a sectional view on the line 3—3, Fig. 4; Fig. 4, is a sectional view on the line 4—4, Fig. 2; Fig. 5, is a sectional view on the line 5—5, Fig. 2; and Figs. 6 and 7, are views illustrating details of my invention.

A, A are the walls of the elevator well.

a, *a* are the landing floors.

B is the interlock mechanism located at each landing floor; being secured to the walls of the elevator well in any suitable manner.

D is the elevator car and this car carries on its underside the other part of the interlocking mechanism.

c is the hand cable or rope which, in the present instance, passes through a tubular shield C on the car D. This hand cable is connected to the valves or other controlling mechanism either at the base or at the head of the elevator well. In the present construction the valve operating mechanism is at the base of the well and the cable passes over two sprocket wheels c', c^2 at the head of the well; the cable at this point being in the form of a chain so as to engage the sprocket wheel c^2 to insure its turning as the cable is moved in either direction.

On the shaft C′ carrying the sprocket wheel c^2 is a sprocket wheel e' around which passes the controlling cable *e*. This cable also has a chain section where it passes around the wheel so as to insure its moving with the wheel. On one strand of the cable *e* is secured a cam E, which is tapered at each end e^2, as shown in Figs. 2 and 7; there being one of these cams at each landing door. The cams E are connected by links e^3 to brackets E′ secured to the elevator well so that when the cable *e* is moved vertically the cams will be moved into and out of operative position with the mechanism on the elevator car. The other strand of the cable *e* is attached to a slide F adapted to slideways *g* on a frame G secured to the wall of the elevator well. These slideways in the present instance are in the form of round bars and carried by the slide are two transverse rods *f* on which is mounted a sliding toothed plate F′. The teeth of this plate are so shaped as to be engaged by the teeth *i* of a bracket I secured to the underside of the car D, and illustrated in detail in Fig. 6, so that when the teeth of the bracket and the teeth of the sliding plate are in engagement any movement of the car will be transferred to the cable *e* through the toothed bracket I and the toothed plate F′, and as the cable *e* is geared to the controlling mechanism *c* through the sprocket wheels at the head of the elevator well this motion will be communicated to the valve mechanism, consequently the car will be always maintained at the landing, as any drop in the car will operate the valve mechanism so as to bring it back to position.

H is the landing door closing the entrance to the elevator well. This door has at one corner a hooked bar *h* with which engages a latch K pivoted at *k* to the frame G. A spring *k′* tends to force the latch out and into engagement with the hooked bar *h*. This latch when in its normal position engages the hooked bar *h* and prevents the door being opened until the car is at the landing.

In order to push the latch back clear of the hooked bar *h*, I provide a slide N mounted in ways on the underside of the car floor D. This slide has a roller *n* which is adapted to press against the latch K when moved forward. Pivoted to the underside of the car at *m* is a lever M which projects beyond the edge of the car, as shown in Fig. 4, so as to be acted upon by the shifting cam E. On the end of the lever is a roller *m′* which travels on the cam E. On the slide N is a

pin n' which enters a slot in the lever M so that any movement of the lever will be imparted to the slide. When the cam E is shifted clear of the roller m' then the lever M and the slide N will not be actuated.

In order to return the slide N after it is free of the control of the cam E, I provide a lever N′, which is pivoted at n^2. One arm of this lever is connected by a link N^2 to the slide N and the other arm is weighted, as clearly shown in Fig. 2.

S is a weighted lever pivoted at s to the frame G and one arm of this lever is connected by a link s' to a pin s^2 on the sliding toothed plate F′. This arm of the lever is in line with the depending bar h' carried by the door H and the weight s^3 is sufficient to move the sliding plate to position in line with the toothed bracket I when the lever is released on the opening of the door. When the door is closed the depending bar pushes the lever S and moves the plate out of line with the toothed bracket I on the car D.

The operation is as follows:—When the car is in motion then the cam E is out of the path of the end of the lever M carried by the car, and as the door is closed the parts on the elevator well and those on the car are out of line so that the mechanism will not be operated. When a car is stopped at a landing the movement of the cable will cause the cam E to be shifted into the path of the lever M on the car and as the car nears the landing the roller m will slide upon the cam E, moving the lever M out and with it the slide N and this slide will push back the latch K and release the door. The moment the door is released and opened the weighted lever S is released and will move the sliding, toothed plate F′ into engagement with the toothed bracket I on the car. This movement couples the cable e with the controlling cable c, so that any movement up or down of the car will be transferred to the operating cable c and this movement will operate the controlling valves to return the car to its normal position with its floor in line with the floor of the landing, so that any leakage in the valve mechanism will not interfere with the proper alinement of the car floor with the landing. Moreover, the toothed bracket on the car prevents the movement of the controller rope c while the landing door is open, as the cable e is connected to the controller cable c through the mechanism at the head of the elevator well. As soon as the door is closed the depending bar h' forces the sliding toothed plate F′ out of engagement with the toothed bracket I, thus freeing the car D from the control of the toothed plate F′, and as the controller rope is operated to start the car in either direction it will shift the cam E out of the path of the lever M, at the same time the lever and the slide N will be withdrawn by the weighted lever N′. This will release the latch K, which will engage the hooked bar h and this will prevent the opening of the door until the car is again brought to a stop at the landing.

I claim:—

1. The combination in interlocking mechanism for elevators, of a car, a landing, a door at said landing, a latch by which the door is locked in a closed position, means on the car for actuating the latch, a controlling cable, a cam cable extending throughout the well, said cam cable being connected to the controlling cable, a movable cam on said cam cable for operating the latch actuating means, and means for positively connecting the car with the cam cable when the car is at rest.

2. The combination in interlocking mechanism for elevators, of a landing, a car, a controlling cable for actuating the controlling mechanism of the car, a second cable, a cam connected to said second cable adapted to be thrown into and out of action when said cable is moved in either direction, a slide on the body of the car, a lever on the car engaging the slide and arranged to be actuated by said cam when in position, a latch on the elevator well actuated by the slide, a landing door locked by the latch, and means for positively coupling the cam cable to the car when the landing door is open.

3. The combination in interlocking mechanism for elevators, of a landing, a door closing the landing, a latch on the elevator well for locking the door in a closed position, a car means on the car for actuating the latch, a controlling cable extending throughout the well, a cam mounted in the well, a cable attached to said cam and also extending throughout the well, means connecting the cam cable with the controlling cable so that when the controlling cable is moved to stop the car the cam will be shifted into position to move the latch actuating mechanism of the car.

4. The combination in interlocking mechanism for elevators, of a landing, a landing door, a latch in the elevator well for locking the door in its closed position, a car means on the car for actuating the latch, a controller for stopping and starting the car, a cam pivoted to the side of the elevator well, a cable connected to the cam and to the controlling mechanism of the car, a toothed bracket on the car, a toothed plate on the wall of the elevator well, and means whereby the two elements can be thrown into and out of engagement on the opening or closing of the door, said toothed plate being connected to the cable to which the cam is attached.

5. In interlocking mechanism for elevators, the combination of a landing, a landing

door, a latch for locking the door in its closed position, a car means on the car for actuating the latch, a controller for stopping and starting the car, a cam on the side of the elevator well, a cable connected to the cam so that on the movement of the cable the cam will be moved into and out of position to engage the actuating mechanism on the car, a slide on the elevator well to which the cable is also attached, a sliding toothed plate carried by the slide, a toothed bracket on the car arranged to be engaged by the sliding plate, and means on the door for moving the plate into and out of position, the said cable being connected to the controlling mechanism so that any movement of the car after it is brought to the landing will be imparted to the controlling mechanism so that the floor of the car will be in line with the landing.

6. The combination in interlocking mechanism for elevators, of a landing, a landing door, a latch for locking the landing door in its closed position, a car, latch operating mechanism on the car, a controlling cable, a cam pivoted to the side of the elevator well, a cable connected to the cam, the two cables being connected together at the head of the elevator well, a toothed bracket on the car, a carrier attached to the cable which is connected to the cam, a sliding toothed plate on the carrier adapted to be moved into engagement with the toothed bracket on the car, a weighted lever connected to the toothed plate, and means on the door for actuating the lever to shift the plate out of engagement with the toothed bracket when the door is closed.

7. The combination in interlocking mechanism for elevators, of a series of landings, a door at each landing, a car, a hand cable extending through the elevator well and connected to the controlling mechanism of the car, a cam pivoted to the side of the elevator well at each landing, a cable attached to the several cams and connected to the controlling cable, a latch on the wall of the elevator well at each door and adapted to lock the door when in its closed position, a slide on the car, a roller carried by the slide adapted to press against the latch and release the door, a weighted lever connected to the slide, a pivoted arm also connected to the slide and adapted to be actuated by one of the cams when said cams are moved into position, a toothed bracket on the car, guides at each landing, slides adapted to move vertically on the guides, each slide being connected to the cam cable, a toothed plate mounted to move transversely on each slide and to engage the toothed bracket on the car when the car is at the landing, a weighted lever connected to said sliding plate, and an arm on the door adapted to strike said lever and shift the plate when the door is moved to the closed position.

8. The combination in interlocking mechanism for elevators, of a series of landings, a door at each landing, a plate secured to the elevator well at each landing, a spring latch pivoted to each plate and adapted to engage and lock the landing door when said door is closed, vertical guides on each plate, a slide adapted to the guides, a cam pivoted to the wall of the elevator well at each landing, a cable connecting the several cams and the several slides, a wheel around which the cable passes, a car, a controlling cable connected to the controlling mechanism of the car, a wheel around which the said cable passes, said wheel being mounted on the same shaft as the wheel of the cam cable so that one cable will move with the other, transverse guides on each slide, a toothed plate mounted on each of the transverse guides, a toothed member on the car adapted to be engaged by the toothed plate, means on the car engaged by the cam for operating the latch, and means on the door for moving the plate out of line with the toothed member on the car when the door is closed.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

JOHN S. MUCKLÉ.

Witnesses:
WM. E. SHUPE,
WM. A. BARR.

B. A. SNYDER & M. A. CUSTIS.

DOOR ATTACHMENT FOR ELEVATOR FREIGHT COMPARTMENTS.

APPLICATION FILED JULY 30, 1909.

957,807. Patented May 10, 1910.

Fig. 2.

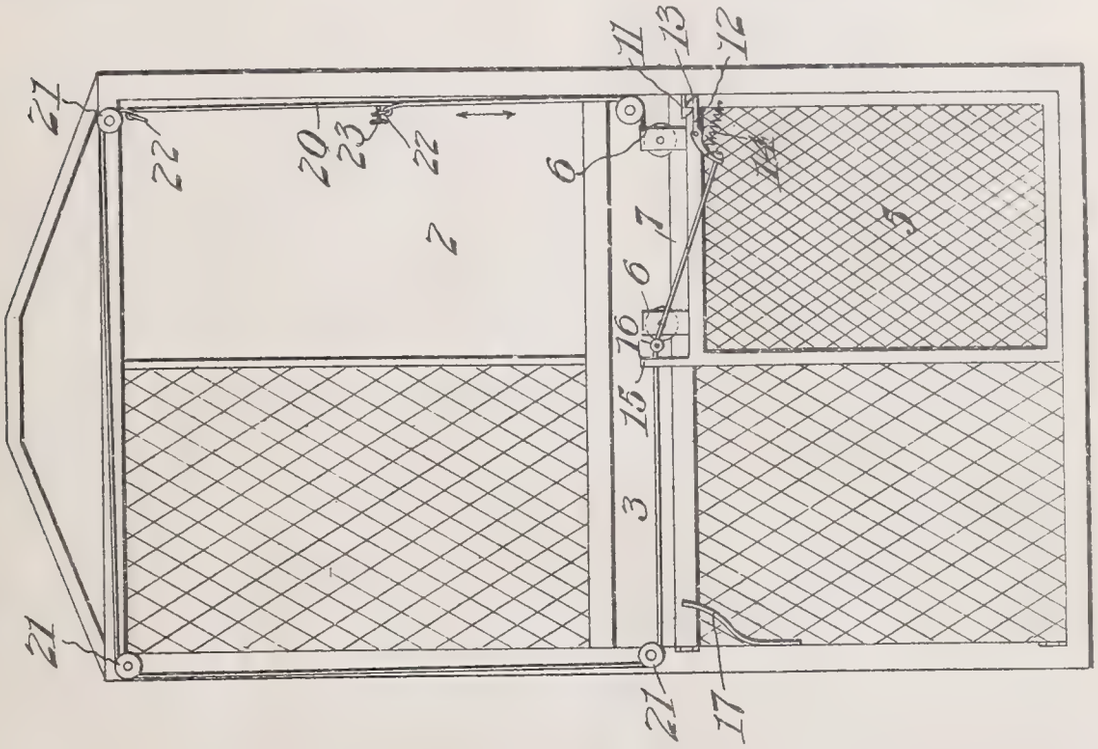
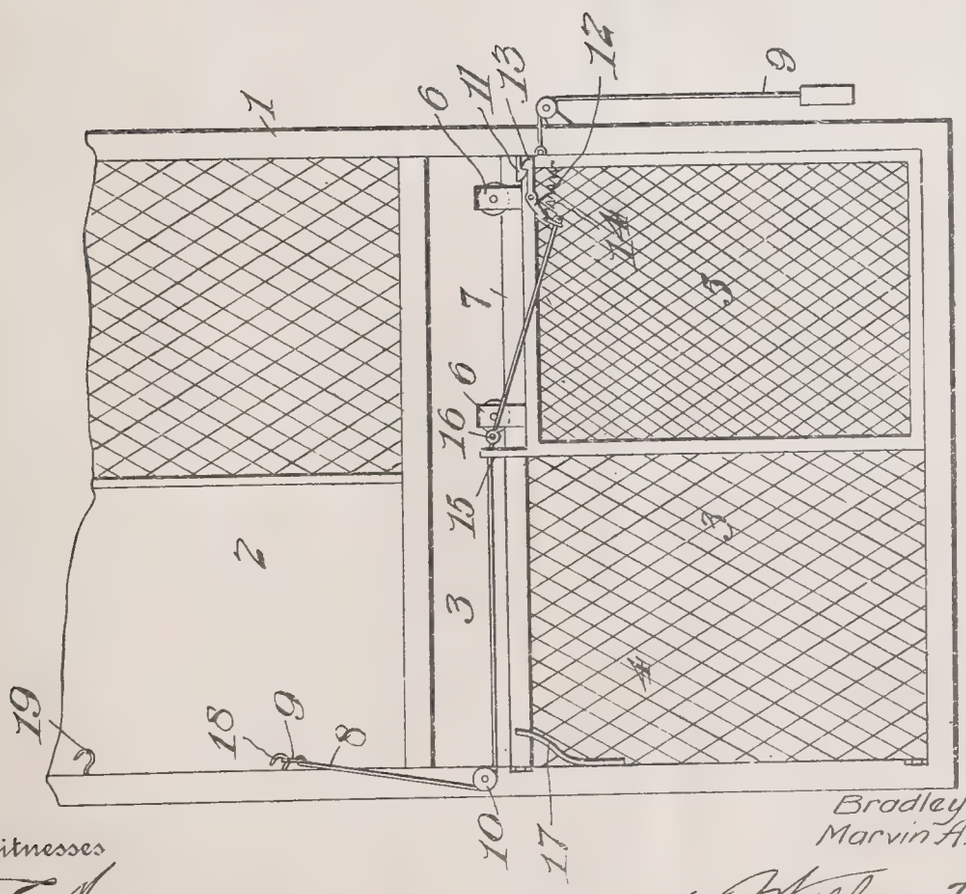


Fig. 1.



Witnesses

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By D. P. Wolhaupter

Their Attorney

UNITED STATES PATENT OFFICE.

BRADLEY A. SNYDER, OF HYATTSVILLE, MARYLAND, AND MARVIN A. CUSTIS, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNORS TO SAID MARVIN A. CUSTIS.

DOOR ATTACHMENT FOR ELEVATOR FREIGHT-COMPARTMENTS.

957,807. Specification of Letters Patent. **Patented May 10, 1910.**

Application filed July 30, 1909. Serial No. 510,474.

To all whom it may concern:

Be it known that we, BRADLEY A. SNYDER and MARVIN A. CUSTIS, citizens of the United States, residing, respectively, at Hyattsville, county of Prince George, State of Maryland, and at Washington, District of Columbia, have invented certain new and useful Improvements in Door Attachments for Elevator Freight-Compartments, of which the following is a specification.

This invention relates to the subject of elevators, and has special reference to that type of elevators carrying separate compartments respectively for passengers and for freight. In this class of elevators, the freight compartment is a frequent and constant source of danger by reason of the fact that it is ordinarily underneath the passenger compartment entirely out of sight of the operator, and is also always, so far as we are aware, unprotected by doors or closures of any kind. Hence, it is the purpose of the present invention to provide a reliable and safe door attachment for elevator freight compartments of the kind referred to, and which compartment is under the ready and convenient control of the elevator operator within the passenger compartment.

Various forms of construction may be utilized in carrying out the invention, but for illustrative purposes, certain embodiments thereof are shown in the accompanying drawings, in which:

Figure 1 is a side elevation illustrating a combined passenger and freight elevator equipped with the present invention, showing one form of the latter. Fig. 2 is a similar view showing another form of the invention.

Like references designate similar parts in the separate views.

The invention is applicable to any of the well known form of combined passenger and freight elevators, that is an elevator having superposed passenger and freight compartments.

For illustrative purposes, there is shown in the drawings the general outline and form of an elevator car 1 having the separate passenger and freight compartments 2 and 3 respectively, the latter being adapted, according to the present invention, to be protected at the front open side thereof by the hinged grating 4 or equivalent front wall and a sliding door or equivalent closure 5 arranged to cover and uncover the protected space. As shown, the door 5 is of the sliding type, being suspended from roller hangers 6 traveling on a track rail 7 and associated with the door 5 is door operating mechanism comprising both opening and closing means. As shown in Fig. 1, the door opening means may consist of an operator's draw element or its mechanical equivalent 8 having a handle or equivalent member 9 exposed to the operator within the passenger compartment 2. The closing means may consist of a weighted or equivalent pull connection 9 connected with the door 5 at a suitable point, and exerting stress in a direction to close the door. The operator's draw element consists of a cable, chain, or equivalent flexible connection guided about the suitable direction pulley or pulleys 10 and so connected with the door as to provide for opening the latter when the element 8 is pulled by the operator.

An auxiliary feature which may be used, is that of a latch device for securely holding or fastening the door in its closed position. This latch device is intended to be released by the operator's draw element and may consist of a fixed shouldered keeper element 11 and a pivotal latch lever 12. The latch lever 12 is pivotally mounted on the door 5 and is provided with a beveled catch hook 13 for engagement with the keeper element 11 and normally held or restrained in an operative position by a retractile spring 14. One arm of the lever 12 has connected thereto one end of the draw element 8 which operates through a suitable guide 15 and carries an adjustable button or equivalent stop 16 which is drawn against said guide or other fixed member on the door when the latch lever is released by the initial pull on the draw element 8. Thus, the draw element 8 has an initial limited play to release the latch device before pulling upon the door to open the latter.

A starting buffer spring 17 may be arranged in the path of the door 5 so as to be engaged and placed under tension by the latter when fully opened. When the operator releases his pull on the element 8, the spring 17 will exert an initial starting impulse in the direction of closing the door. When the door is closed, the operator's draw element 8 may be hooked onto a hook or equivalent holding element 18, and likewise when the door is open, may hook onto an-

other hook or equivalent holding element 19, both of said hooks 18 and 19 being arranged in or on the passenger car of the elevator.

The modification shown in Fig. 2 suggests the expedient of omitting the weighted pull connection 9 and using in place thereof an operator's pull connection 20 which is connected with the door upon opposite sides so as to provide for both opening and closing. The operator's pull connection 20 is the equivalent of both the opening and closing means of the other form of the invention described, and is in effect an endless cable, or equivalent flexible connection arranged about suitable direction pulleys 21. The other features herein described may or may not be used with the modification shown in Fig. 2, but in the latter form of the invention it will be observed that the pull connection 20 may be provided with handles or equivalent elements 22 adapted to be engaged with holding means 23 when the door is respectively open and closed.

From the foregoing description, it is to be understood that in referring to elevators carrying separate compartments respectively for passengers and for freight, the term "freight compartment" is intended to mean any compartment supplemental to the main passenger compartment and employed for carrying servants, freight, and as a general utility compartment, except for regular passengers. Also, it is to be understood in this connection that the invention is intended to apply to and comprehend any form of closure for the supplemental compartment, and which closure is controllable through operating mechanism which is operable absolutely from the main compartment of the elevator. Also, the auxiliary latch device which is employed is entirely automatic in its action and is preferably designed to be placed entirely out of the reach of the occupant of the supplemental or freight compartment.

Various changes in the form, proportion, and minor details of construction may be resorted to without departing from the scope or sacrificing any of the advantages of the invention.

We claim:

1. In combination with an elevator car having a freight compartment, of a movable closure for said compartment, and operating mechanism exposed for manipulation to the operator in the passenger compartment and comprising means for opening and closing said closure.

2. In an elevator, the car having passenger and freight compartments, a closure door for the freight compartment, and door operating mechanism having an operator's element exposed to the operator in the passenger compartment.

3. The combination with an elevator car having passenger and freight compartments, of a closure door for the freight compartment, and door operating mechanism having opening and closing means for the door, said mechanism being exposed for manipulation by the operator within the passenger compartment.

4. The combination with an elevator car having passenger and freight compartments, of a closure door for the freight compartment, a latch device for the door, and a releasing connection with the latch device, said connection having an operator's element exposed to the operator in the passenger compartment.

5. The combination with an elevator car having passenger and freight compartments, of a closure door for the freight compartment, and door operating mechanism including an operator's draw element exposed to the operator in the passenger compartment, and holding means for securing said element when the door is in either an open or closed position.

6. The combination with an elevator car having passenger and freight compartments, of a closure door for the freight compartment, door operating mechanism having opening and closing means for the door, and a buffer spring arranged to exert a starting impulse to the door in the direction of closing.

7. The combination with an elevator car having passenger and freight compartments, of a closure door for the freight compartment, an operator's draw element connected with the door to provide for the opening thereof and having its operated portion exposed within the passenger compartment, and a weighted pull connection with the door for closing the same.

8. The combination with an elevator car having passenger and freight compartments, of a closure door for the freight compartment, an automatically locking latch device for the door having a pivotal latch lever, an operator's draw element having a limited initial play and connected with said latch lever, said element being exposed in the passenger compartment for manipulation by the operator in the latter, and closing means for the door.

9. The combination with an elevator car having a supplemental compartment, of a movable closure for said compartment, and operating mechanism adapted to be manipulated by the operator in the main compartment and comprising means for controlling the opening and closing of the said closure and for locking the same against manipulation by the party in the said supplemental compartment.

10. The combination with an elevator car having a supplemental compartment, of a movable closure for said compartment, and

operating mechanism adapted to be manipulated by the operator in the main compartment and comprising means for opening said closure.

11. The combination with an elevator car having a supplemental compartment, of a movable closure for said compartment, and operating mechanism adapted to be operated by the operator in the main compartment and comprising means for locking said closure against manipulation by persons in the supplemental compartment.

12. The combination with an elevator car having a supplemental compartment, of a movable closure for said compartment, and operating mechanism adapted to be operated by the operator in the main compartment and comprising means for locking said closure against manipulation by persons in the supplemental compartment, when said closure is in a closed condition.

13. The combination with an elevator car having main and supplemental compartments, of a movable closure for the supplemental compartment, means operable solely from the main compartment for operating said closure in one direction, and yieldingly-acting means for operating said closure in the other direction.

14. The combination with an elevator car having a main and supplemental compartment, of a movable closure for the supplemental compartment, means operable from the main compartment for operating said closure in one direction, and yieldingly-acting means for operating said closure in the other direction and locking the same against manipulation by the occupant of the supplemental compartment.

15. The combination with an elevator car having a supplemental compartment, of a movable closure for said compartment and means adapted to be manipulated by the operator in the main compartment, for controlling the opening and closing of said closure, and also for locking the same in either condition against interference from the occupant in the supplemental compartment.

16. The combination with an elevator car having a main and a supplemental compartment, of a movable closure for the supplemental compartment, a locking latch for locking said closure when in a closed condition, and means having a limited initial movement for unlocking the latch and its further movement for opening the said closure, said means being adapted to be manipulated by the operator in the main compartment.

17. The combination with an elevator car having a main and a supplemental compartment, of a movable closure for the supplemental compartment, means operable from the main compartment for operating said closure in one direction, and yieldingly-acting means for operating said closure in the other direction.

18. The combination with an elevator car having a main and a supplemental compartment, of a movable closure for the supplemental compartment, means operable from the main compartment for unlocking said closure and for operating the same in one direction, and yieldingly-acting means for operating said closure in the other direction.

In testimony whereof we hereunto affix our signatures in the presence of two witnesses.

BRADLEY A. SNYDER.
MARVIN A. CUSTIS.

Witnesses:
R. C. Braddock,
Emory L. Groff.

T. H. STRALEY.

MEANS FOR LOCKING ELEVATOR CAR DOORS.

APPLICATION FILED MAR. 7, 1910.

968,283. Patented Aug. 23, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

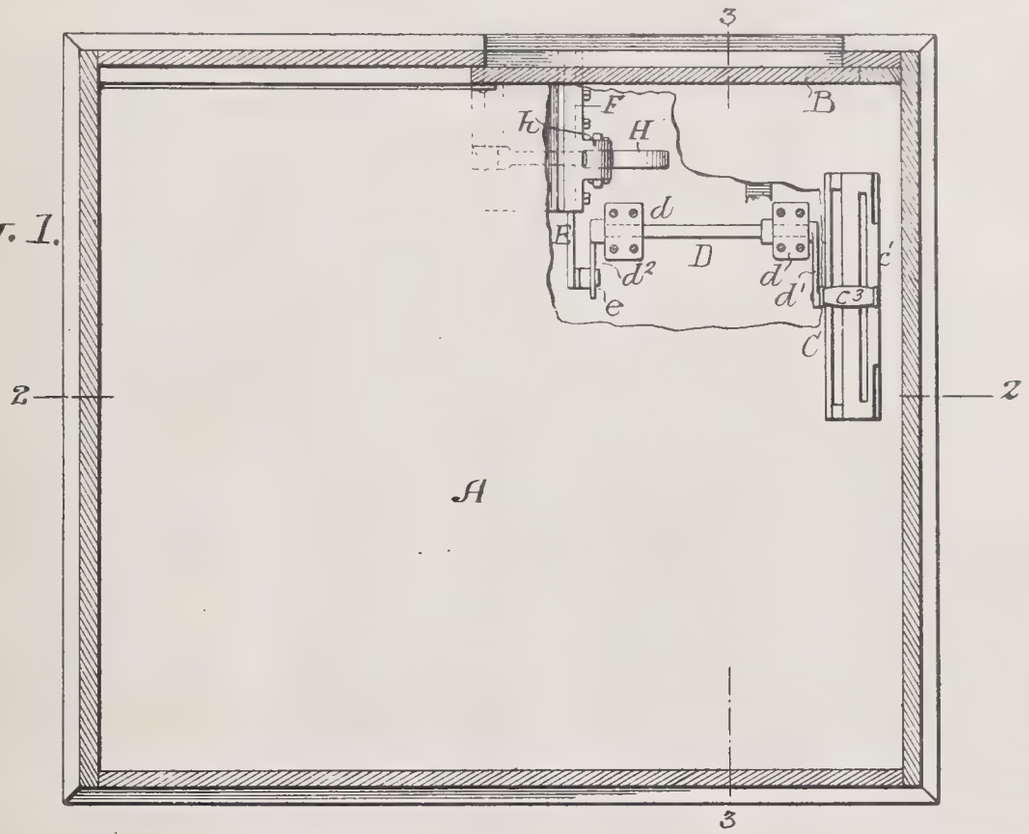
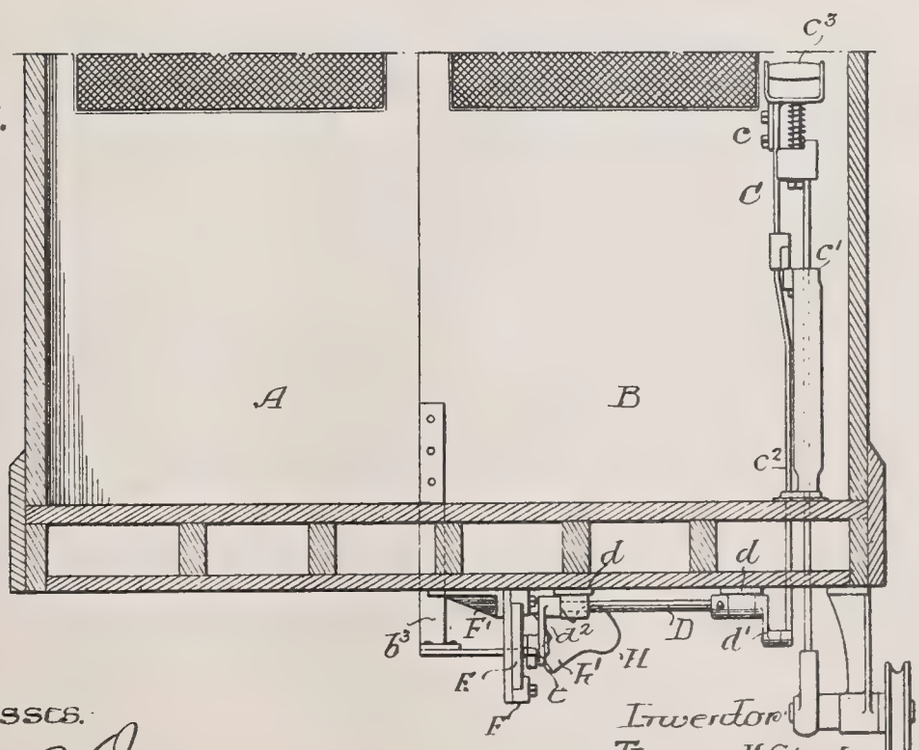


Fig. 2.



Witnesses.

Titus H. Gross.

Wills A. Burrowes

Inventor

Thomas H. Straley

by His Attorneys.

Howson & Howson

THE NORRIS PETERS CO., WASHINGTON, D. C

T. H. STRALEY.

MEANS FOR LOCKING ELEVATOR CAR DOORS.

APPLICATION FILED MAR. 7, 1910.

968,283. Patented Aug. 23, 1910.

2 SHEETS—SHEET 2.

Fig. 3.

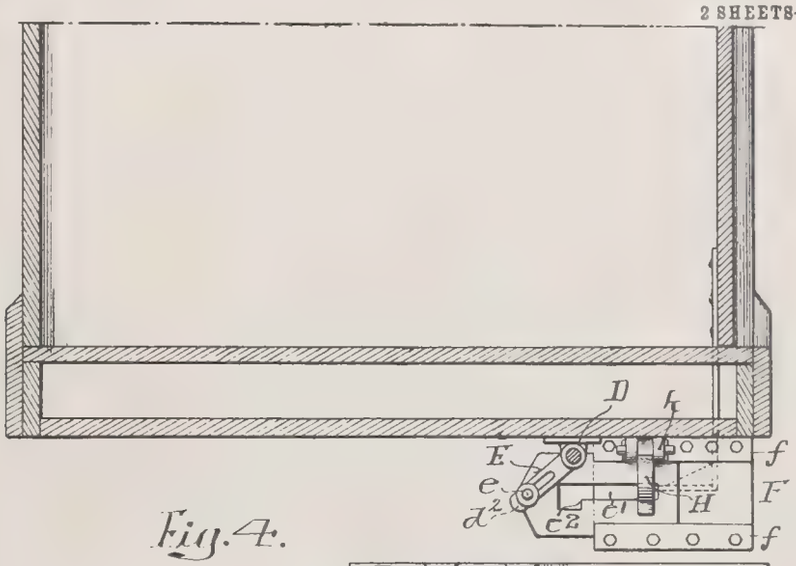


Fig. 4.

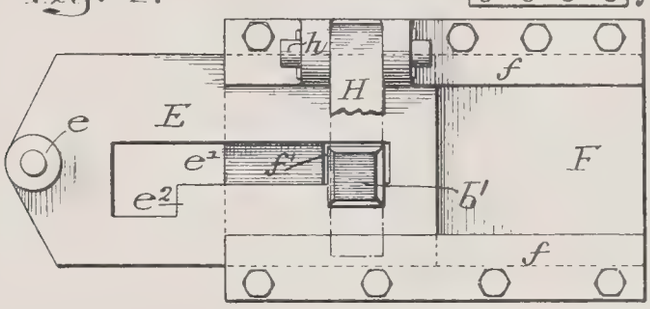


Fig. 6.

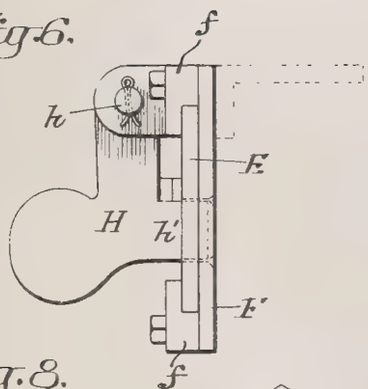


Fig. 5.

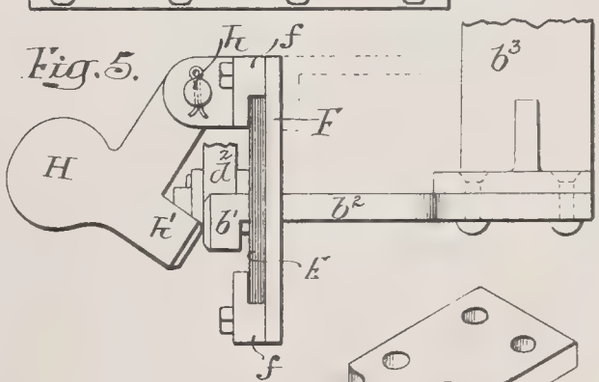


Fig. 8.

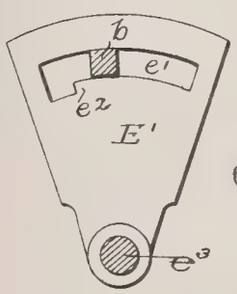
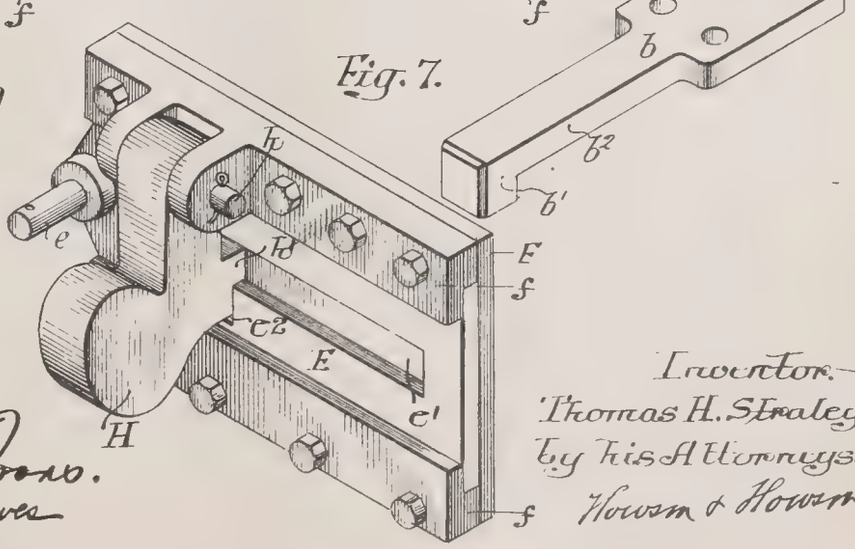


Fig. 7.



Witnesses.—

Titus H. Howard.

Wills A. Burrowes

Inventor.—

Thomas H. Straley.

by his Attorneys.—

Howson & Howson

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

THOMAS H. STRALEY, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO STANDARD ELEVATOR INTERLOCK COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

MEANS FOR LOCKING ELEVATOR-CAR DOORS.

968,283. Specification of Letters Patent. Patented Aug. 23, 1910.

Application filed March 7, 1910. Serial No. 547,850.

To all whom it may concern:

Be it known that I, THOMAS H. STRALEY, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Means for Locking Elevator-Car Doors, of which the following is a specification.

The object of my invention is to provide means for locking the door of an elevator car when closed, said means locking the controlling mechanism when the door is opened so as to prevent the starting of the car until the door is closed.

In the accompanying drawings,—Figure 1, is a sectional plan view, the elevator car partly broken away to illustrate my invention; Fig. 2, is a sectional view on the line 2—2 Fig. 1; Fig. 3, is a sectional view on the line 3—3 Fig. 1; Fig. 4, is a side view of my improved lock detached from the car; Fig. 5, is an end view of the lock illustrated in Fig. 4, showing the projection on the door engaged by the slide, locking the door in the closed position; Fig. 6, is an end view showing the position of the parts when the door is opened; Fig. 7, is a detached perspective view of the lock and the projection on the door; Fig. 8, is a view of a modification.

A is the elevator car, B is a sliding door adapted to ways on the car.

C is the controlling mechanism which is the ordinary type of lever control consisting of a lever c adapted to travel over a segment c', and by moving this lever to the center position the car is brought to a standstill, and by moving it over to one side the mechanism is so thrown that the car will be raised, and by throwing it over to the opposite side the car will be lowered. This control mechanism may be connected to any suitable mechanism in the elevator well for actuating the valves or other means.

D is a shaft mounted in bearings on the under side of the car. This shaft has an arm d' which is connected to a rod c^2 leading from the handle c^3 of the controlling mechanism, so that when the controlling mechanism is moved the shaft D will be rocked in its bearings. On the opposite end of the shaft D is a lever d^2 which is slotted as shown in Fig. 3, for the reception of a pin e of a locking device E in the form of a slide, this slide being adapted to guides f in a plate F secured to the under side of the car in the present instance being attached to a bracket F'. The slide E has a slot e' which is enlarged at one end to form a shoulder e^2.

H is a weighted lever pivoted at h and having a projection h' which is adapted to fit the enlarged portion of the slot e' and rest against the shoulder e^2 when in the position shown in Fig. 6, thus locking the slide in a fixed position and preventing the movement of the operating mechanism of the car.

In the plate F is an opening f' through which may be projected a bar b having a hooked end b'. The body portion b^2 of the bar b fits snugly in the narrow portion of the slot e' in the slide E and the hooked end will readily pass through the enlarged portion of the slot, so that when the bar is pushed through the plate and the slide, as in Fig. 5, and the slide moved longitudinally, the hooked end of the bar will be engaged by the plate and the bar will be held, and as this bar is attached to a depending portion b^3 of the door B it will hold the door in the closed position.

In some instances it is necessary to provide an elevator car with a door in addition to the door at the landing of the elevator well, and by the above construction I provide means for locking the elevator car door while the car is in motion, and also lock the operating mechanism when the door is open at the landing so as to prevent the starting of the car when passengers are passing through the doorway.

If the door is open and the slide is in the position illustrated in Figs. 6 and 7, the weighted lever H is in engagement with the slide and prevents the movement of the operating mechanism, but on the closing of the door the projecting bar b which is in line with the weighted lever passes through the openings in both the plate and the slide and pushes the weighted lever H out of contact with the slide, as in Fig. 5, so that the operating mechanism can be shifted to either cause the car to be raised or lowered. As soon as the slide is shifted it will pass back of the hooked end of the bar b and thus lock the bar in its closed position and it will be impossible to open the door until the controlling mechanism is brought to central position to stop the car, when the door is

free from the locking mechanism and can be opened.

In Fig. 8, I have illustrated the locking device in the form of a segment E′ pivoted at e^3 to any suitable support or mounted directly on the rock shaft D, and this segment has a slot e' and shoulder e^2.

I claim:—

1. The combination in an elevator, of a car, a sliding door on the car, a movable locking device mounted on the car, car controlling means connected to the locking device, and a bar on the door adapted to be engaged by the locking device when said device is shifted to move the car, with means engaging the locking device when the door is open so as to prevent the movement of said device until the door is closed.

2. The combination in an elevator car, of a door arranged to slide on said car, a slotted sliding locking device, car controlling means connected to the said locking device, a headed bar on the door adapted to be engaged by the locking slide when the door is closed, and means for preventing movement of the locking slide when the door is opened, said means being actuated by the bar on the door.

3. The combination in an elevator of a car, a door on the car, controlling mechanism on the car, a slotted locking device, a bar on the door arranged to be projected through the slot in the locking device, and a weighted lever in line with the bar and adapted to engage the locking device when the bar is retracted so as to prevent the movement of the operating means, the bar when projected in the slot pushing the lever out of engagement and on the movement of the locking device being retained and thus locking the door in its closed position.

4. The combination in an elevator of a car, a door on the car, a bar carried by the door having a hooked end, a slotted locking device, one end of the slot being enlarged forming a shoulder, and controlling mechanism on the car connected to the locking device so that when the bar is pushed through the slot in the locking device and the said locking device moved, it will prevent the bar from being retracted.

5. The combination in an elevator of a car, a sliding door, controlling mechanism on the car, a rock shaft connected to the controlling mechanism, a plate located on the under side of the car having slide-ways, a slide adapted to said ways actuated by the rock shaft, said slide having an elongated slot therein enlarged at one end, and a bar on the door having a hooked end adapted to enter the enlarged portion of the slot, the shank of the bar fitting the narrow portion of the slot so that when the slide is moved the bar will be prevented from being retracted, thus locking the door in the closed position.

6. The combination in an elevator car of a sliding door, a controlling mechanism on the car, a plate on the under side of the car, guide-ways therein, a slide mounted in the guide-ways and having an elongated slot enlarged at one end forming a shoulder, means connecting the controlling mechanism on the car with the said slide, a pivoted weighted lever having a projection adapted to enter the enlarged portion of the slot in the slide, and a bar on the door having a hooked end alining with the weighted lever and adapted to project through the large portion of the slot in the slide and push the said lever out of engagement with the slot, and after the slide moves, being locked by the slide so as to prevent the opening of the door.

7. The combination in an elevator of a car, a sliding door on the car, controlling mechanism on the car, a rock shaft having two arms, one arm being connected to the controlling mechanism, a plate on the under side of the car having guide ways, a slide mounted in said ways and having a projecting pin adapted to a slot in the other arm of the rock shaft, said slide having an elongated slot enlarged at one end to form a shoulder, a pivoted weighted lever having a projection adapted to enter the enlarged portion of the slot and lock the plate, thus locking the controlling mechanism, with a bar on the door having a hooked end adapted to enter the enlarged portion of the slot in the plate and push the lever out of engagement with the plate, allowing the controlling mechanism to be operated, and when said controlling mechanism is operated the plate will be shifted and will lock the door, thus preventing the door from being opened.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

THOMAS H. STRALEY.

Witnesses:
WM. E. SHUPE,
WM. A. BARR.

H. W. McNAUGHT.

ELEVATOR SAFETY DEVICE.

APPLICATION FILED JAN. 17, 1910.

969,296.

Patented Sept. 6, 1910.

3 SHEETS—SHEET 1.

Fig. 1.

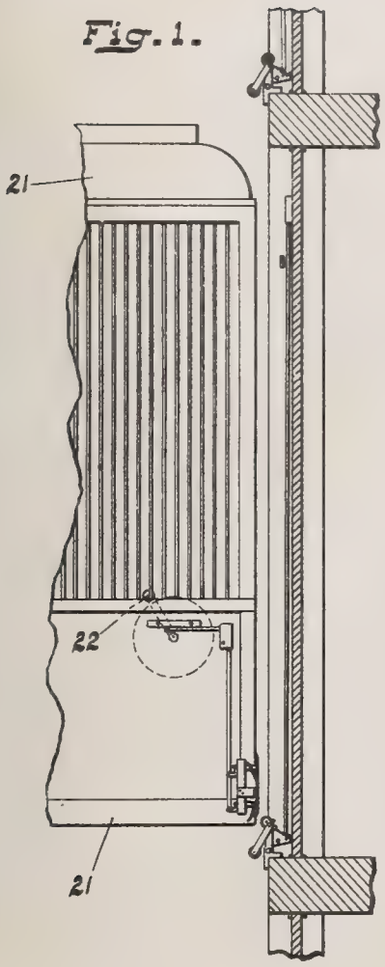


Fig. 2.

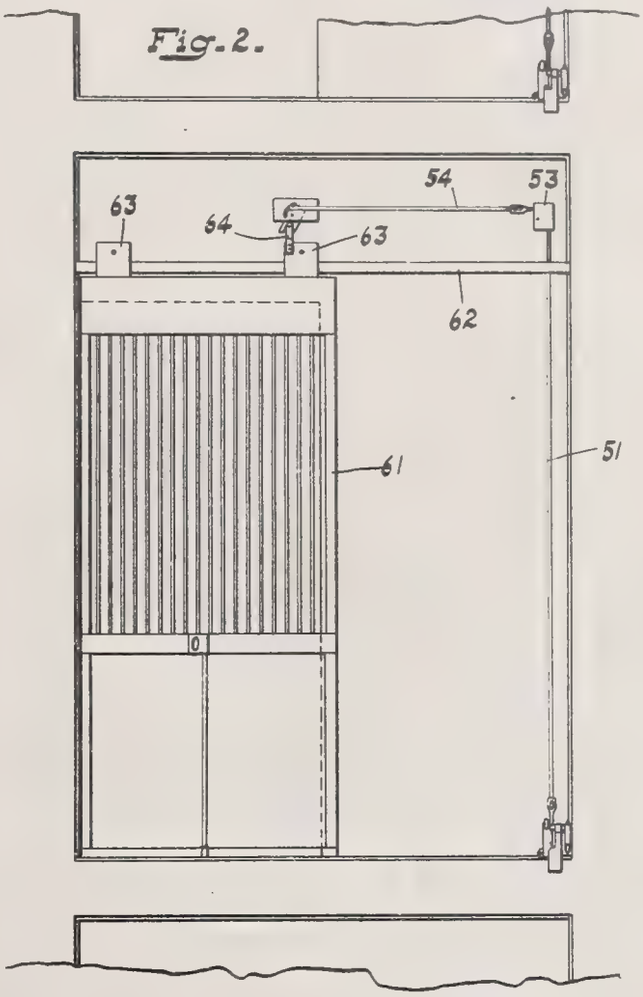
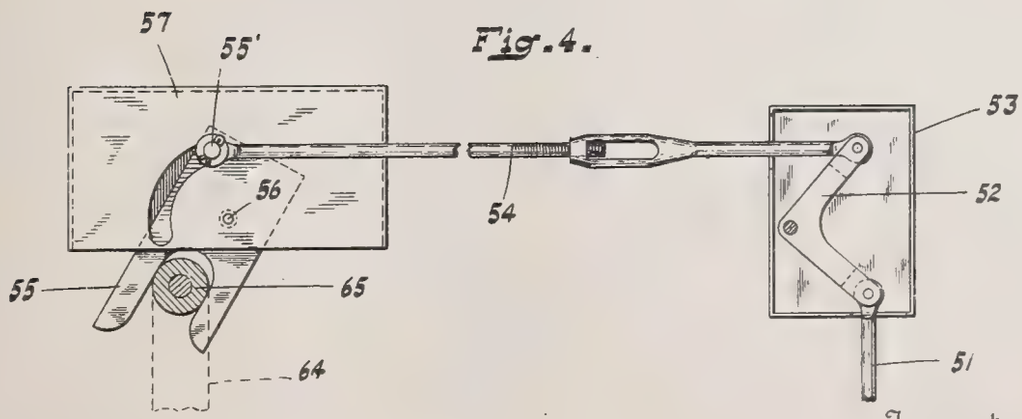


Fig. 4.



Witnesses
Walter Troemel.
Thomas W. McMeans

Inventor.
Harry W. McNaught,
By Bradford & Hood,
Attorneys.

THE NORRIS PETERS CO. WASHINGTON, D. C.

H. W. McNAUGHT.

ELEVATOR SAFETY DEVICE.

APPLICATION FILED JAN. 17, 1910.

969,296.

Patented Sept. 6, 1910.

3 SHEETS—SHEET 2.

Fig. 3.

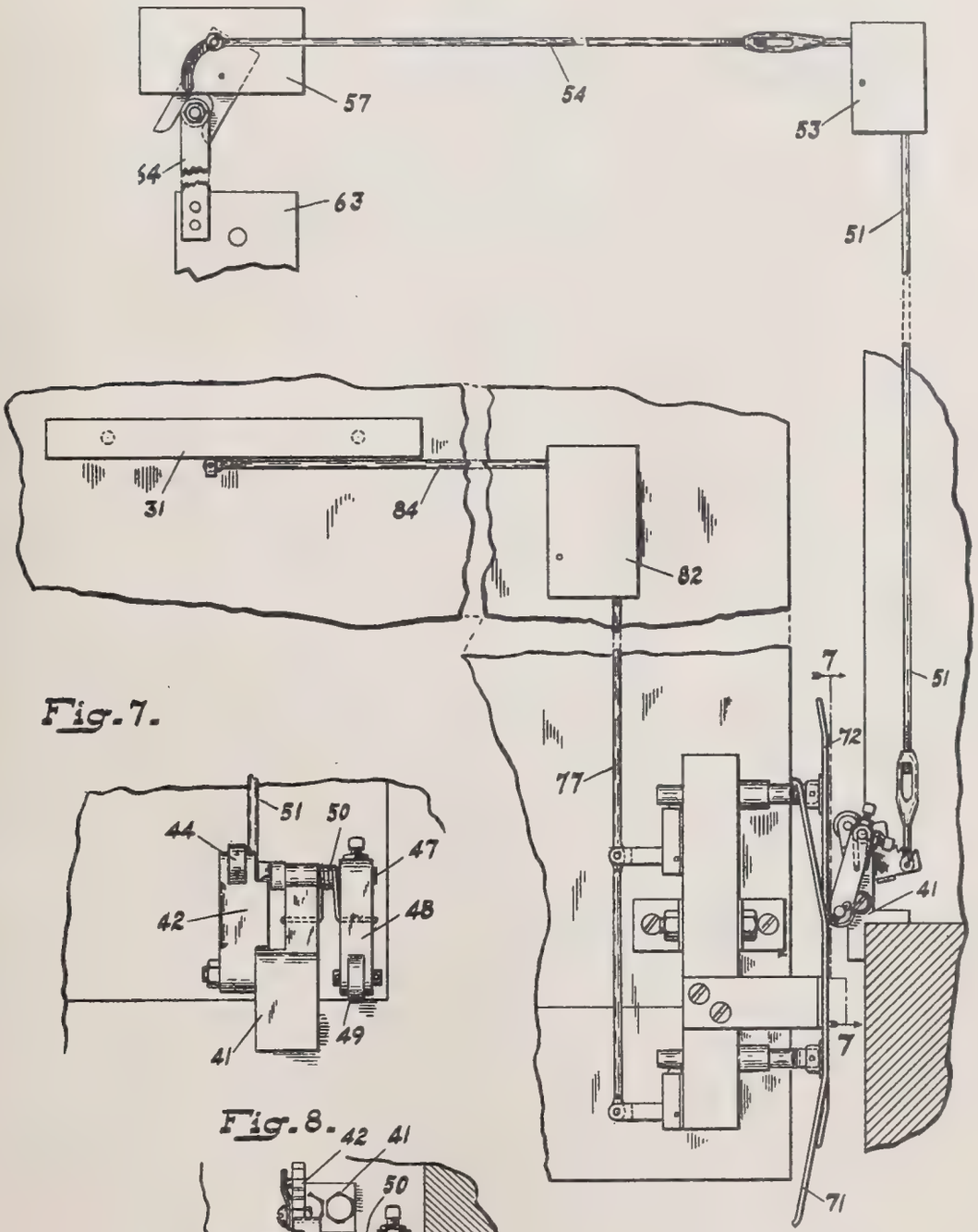
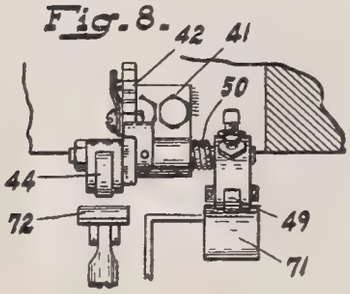


Fig. 7.

Fig. 8.



Witnesses
Walter Froemel.
Thomas W. McMeans

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THE NORRIS PETERS CO., WASHINGTON, D. C.

H. W. McNAUGHT.

ELEVATOR SAFETY DEVICE.

APPLICATION FILED JAN. 17, 1910.

969,296.

Patented Sept. 6, 1910.

3 SHEETS—SHEET 3.

Fig. 10.

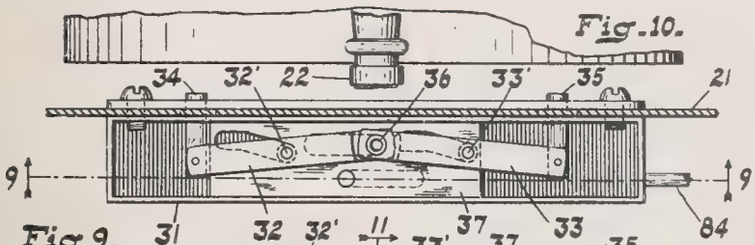


Fig. 9.

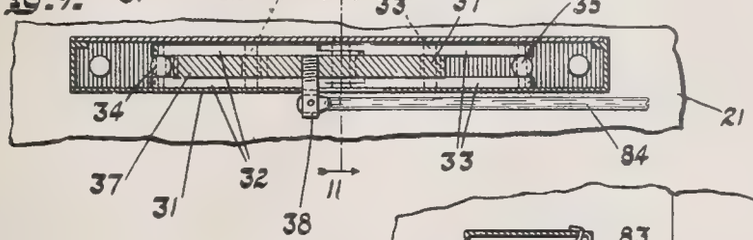


Fig. 11.

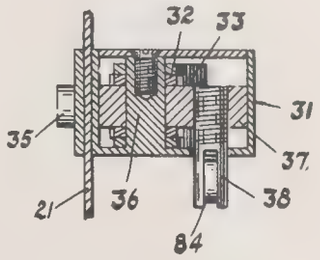


Fig. 5.

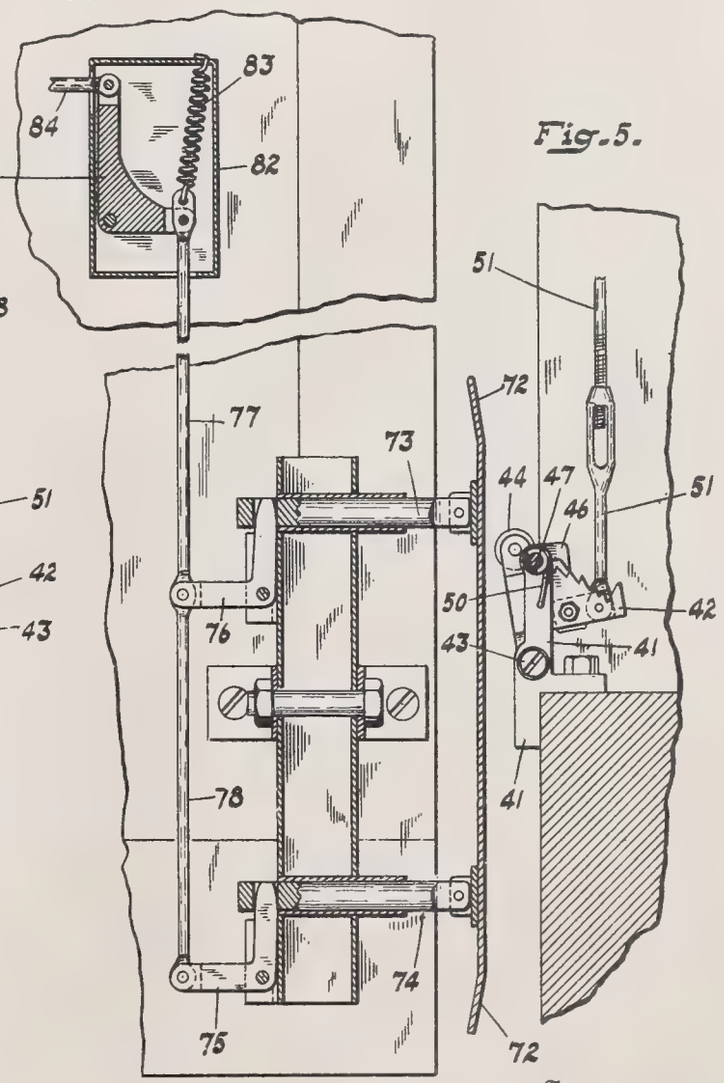
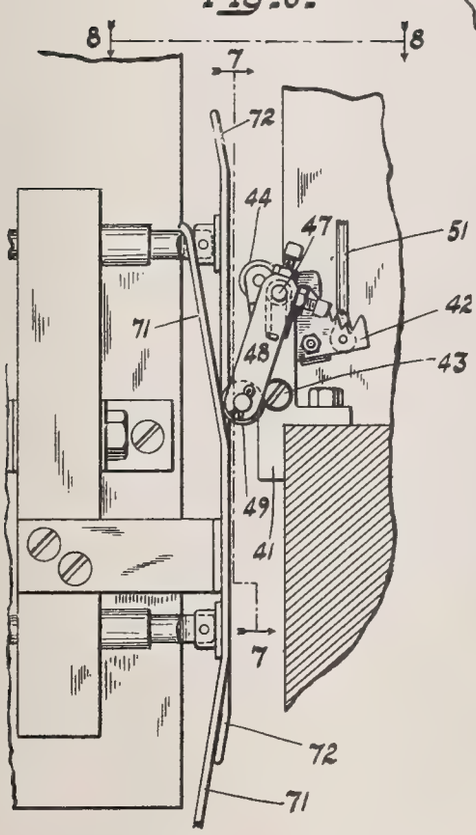


Fig. 6.



Witnesses
Walter J. Roemel.
Thomas W. McMeans

Inventor
Harry W. McNaught,
By Bradford & Hood,
Attorneys.

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HARRY W. McNAUGHT, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO ELEVATOR SAFETY EQUIPMENT COMPANY, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

ELEVATOR SAFETY DEVICE.

969,296. Specification of Letters Patent. **Patented Sept. 6, 1910.**

Application filed January 17, 1910. Serial No. 538,387.

To all whom it may concern:

Be it known that I, HARRY W. McNAUGHT, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a certain new and useful Elevator Safety Device, of which the following is a specification.

The object of my present invention is to produce an apparatus by means of which the gates of an elevator shall be prevented from being opened except when the elevator car is at the level of a floor, and also by which so long as the door is open the elevator car shall be prevented from being operated to ascend or descend.

The apparatus in question will be first fully described and the novel features thereof then pointed out in the claims.

Referring to the accompanying drawings, which are made a part hereof, and on which similar reference characters indicate similar parts, Figure 1 is a view of a fragment of an elevator car together with a fragmentary section of the adjacent portion of the building, illustrating the arrangement of my improved apparatus when used therewith; Fig. 2 an elevation of an elevator gate as seen from the interior of the elevator shaft, together with fragments of adjacent portions of the building; Fig. 3 a view, on an enlarged scale in part like Fig. 2, but including also fragments of the elevator car carrying the mechanism relating to my invention; Fig. 4 a detail view on a still further enlarged scale of the mechanism above the door of the elevator; Fig. 5 a detail view of the mechanism at the bottom of an elevator-door opening and the mechanism on the elevator car adapted to operate in connection therewith, some portions being broken away and other portions being shown in section to illustrate the construction more clearly; Fig. 6 a side elevation of the two strikes at the lower corner of the elevator car, and of the locking levers at a door opening; Fig. 7 a detail elevation as seen when looking in the direction indicated by the arrows from the broken line 7 7 in Figs. 3 and 6; Fig. 8 a top or plan view as seen when looking downwardly from the broken line 8 8 above Fig. 6; Fig. 9 a sectional elevation of the mechanism within the elevator car which operates in connection with the ordinary elevator control lever; as seen when looking in the direction indicated by the arrows from the broken line 9 9 in Fig. 10; Fig. 10 a plan view of the parts shown in Fig. 9 with the cover of the casing which contains the mechanism removed so as to show the working parts, and Fig. 11 a transverse sectional view on an enlarged scale at the point indicated by the broken line 11 11 in Fig. 9.

The elevator car 21 is or may be of any ordinary construction and arrangement, and is designed to be placed in an elevator shaft, where it is caused to ascend and descend by any ordinary or desired means. Within said elevator car, convenient to the hand of the operator, is the ordinary control lever 22 by means of which the driving mechanism of the elevator is caused to operate, and which is designed to be shifted from time to time, according to the service desired, to "ascending", "descending" and "neutral" positions, respectively. As the parts so far mentioned are or may be of any ordinary or desired form or character, and form no part of my present invention, they will not be further described herein, except incidentally in describing the said invention.

Within the car, secured to its wall, just behind the control lever 22, is a casing 31 containing two levers 32 and 33 carrying movable detents or pins 34 and 35, one on either side of the control lever 22, and which are adapted to be projected into the path of said control lever and thus prevent the latter from moving beyond them when so projected; but which, when withdrawn, are out of the path of the control lever so that it is permitted to move freely in the ordinary manner. These levers 32 and 33 are pivotally mounted on a stud 36 in casing 31, and have pins 32′ and 33′ passing through cam slots in a sliding block 37. Said block 37 is arranged to be moved back and forth in casing 31, and thus to project

and withdraw detents 34 and 35. The means for moving the block 37 consists of a pin 38 extending down through the bottom of the casing to which the other mechanism is connected as will be presently described.

Secured to the frame of the building within the elevator well, and near each floor level, is a locking and releasing device controlled in part by the operation of the doors to the elevator wells, at the several floors respectively. This device embodies a frame portion 41 and a notched sector 42 attached thereto by pivot bolt 43, said sector having at its upper end a contact point 44, which is preferably in the form of an anti-friction roller, and which is adapted to engage with a strike (presently to be described) on the elevator car, as said elevator car passes up and down. The sector 42 constitutes also a bell-crank lever, the contact point 44 being one extremity thereof and a pull rod 51 being attached to the other extremity, as will be presently described. When the combined bell-crank lever and notched sector 42 is held upwardly by the pull rod 51, the contact point 44 projects into the path of a yieldingly-mounted strike on the elevator car. Said part 42 is, however, adapted to be held out of contact with said strike, and the parts controlled thereby thus held from operation, by means of a pawl 46 carried by rock-shaft 47. Said rock shaft is adapted to be operated by a swinging arm 48 having a contact point 49 arranged to come in contact with a second rigidly-mounted strike carried by the elevator car, as will be presently described. Contact point 49, like contact point 44, is preferably in the form of an anti-friction roller.

Pull rod 51 runs upwardly to a bell-crank lever 52, preferably contained within a casing 53, at a point just above the level of the top of the elevator door. Another pull rod 54 attached to the other arm of bell-crank lever 52 runs at right angles with pull rod 51, and is attached at the other end to a forked member 55 pivoted at 56 in a box-like casing 57. The connection between pull rod 54 and member 55 is by means of a stud 55′ extending out through an arc-shaped slot in one side of casing 57, concentric with pivot 56.

The doors 61 to the elevator are mounted to move back and forth in any ordinary and well known manner. In the drawing such a door is shown as hung on a track 62 by means of hangers 63. Extending up from the top of the door is an arm 64 (preferably bifurcated at its upper end) carrying an anti-friction roller 65 which engages with the forked end of member 55. As will be readily seen, therefore, the moving of the door back and forth will swing member 55 on its pivot 56, and, through pull rod 54 bell-crank lever 52 and pull rod 51, will move the combined bell-crank-lever and notched sector 42 on pivot 43, except that the movement of pull rod 51 cannot be upward when pawl 46 is in engagement with the teeth of said part 42, as it is then locked against movement in that direction, as already explained.

Secured to the lower portion of the elevator cage are two strikes, one of which, 71, is rigidly mounted, and the other of which, 72, is yieldingly mounted on reciprocating rods 73 and 74, as is best shown in Fig. 5. These rods 73 and 74 are connected at their inner ends by means of bell-crank levers 75 and 76 with a pull rod 77, the two bell-crank levers being connected together by a link 78 by means of which they are caused to operate together, and by means of which, also, the strike 72 is caused to move substantially uniformly as a whole when the corresponding part comes in contact with it at one end, instead of one end swinging ahead of the other, as would otherwise be the case. That is, the strike 72 and the link 78 maintain a substantially parallel relation at all times.

At its upper end rod 77 is connected to a bell-crank lever 81 mounted preferably in an inclosing casing 82, and normally held upwardly by a spring 83. From the other arm of the bell-crank lever 81 a rod 84 runs to and connects with the stud 38. The operation is, therefore, when the strike 72 is pressed inward by the piece with which it comes in contact, that the block 37 is moved longitudinally of casing 31, operating levers 32 and 33, and, through said levers projecting detents 34 and 35 out into the path of control lever 22, thus limiting the movement of said control lever to the distance between the said two detents. This distance being shorter than the effective movement of the control lever, the lever is thereby held to neutral position, and the throwing of it to a position which will cause the elevator car to move is thereby rendered impossible so long as the strike 72 is held in to its inner position, which it always is so long as the elevator door remains open. When the door to the door-opening opposite which the elevator car is at the time is closed, the contact piece which holds the strike 72 inwardly is released, and the action of spring 83 will restore the parts to their normal position, withdrawing the detents 34 and 35 from the path of the control lever 22, thus enabling the operator to manipulate said lever and run the car in the ordinary manner. The

movement in question cannot, however, be given to these parts so long as the elevator door remains open, because, in such case, the bell-crank lever and sector 42 have been swung upwardly and inwardly by the action of forked member 55 operating through the pull rods and bell-crank levers as described. It should be here remarked that the lower end of the segment shaped slot in casing 57 is below the center of pivot 56, so that the parts when they reach the position in question are securely locked against the effect of any direct pull. The shutting of the door, however, of course operates through forked member 55 to throw the member 42 to the position which permits the disengagement of contact point 44 with strike 72, and the consequent withdrawal of detents 34 and 35 by the pull of spring 83.

The features so far described, constitute the means by which it is rendered impossible for the elevator car to be operated to ascend or descend so long as the elevator door is open. The same means, in conjunction with strike 71, constitute the means by which the opening of the door is rendered impossible except when the elevator car is at a floor level.

As heretofore described lever arm 48 on rock shaft 47 carries a pawl 46 which is adapted to engage with the teeth on sector 42, and which is for this purpose a ratchet. A spring 50 operates to hold the pawl into engagement with the ratchet except when forcibly disengaged. The spring 50 is shown as coiled about the rock shaft 47, and having one arm attached to frame 41 and the other to lever arm 48, so that the pawl is held thereby into engagement with the ratchet. When, however, strike 71 on the elevator car comes against contact point 49 on arm 48, the force of the spring is overcome, rock shaft 47 is rocked in its bearings, and pawl 46 is raised out of engagement with the ratchet-faced sector 42, leaving the same free to swing on its pivot as may be desired. It is then, and only then, that the operator, by applying force to the door 61 can move it to the open position, as at all other times sector 42 being locked against movement, pull rod 51 and the parts attached thereto are prevented from upward movement. As the strike 71 only comes in contact with contact point 49 at the time when the elevator car is at a floor level, the result is that the door cannot possibly be opened when the elevator car is in any other position.

It will therefore be seen my apparatus constitutes a complete safety attachment for elevators, insuring both that the doors shall remain closed and locked at all times except when the elevator car is at the floor level, and that the elevator car shall remain at the floor level, without possibility of being caused to ascend or descend, until the door to the elevator opening on the floor in question is closed.

Having thus fully described my said invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with an elevator car, the shaft within which said car operates having door openings at the respective floors of the building which the car passes and doors to said door openings, of two strikes on said elevator car, one fixed and the other yielding, a device secured to the building within the elevator shaft near each floor past which the strikes on the elevator car will travel as it ascends and descends, one member of said device having connections extending to alongside the path of the elevator door in opening and closing, said connections, an arm on the elevator door adapted to engage with said connections as the door is opened and closed and thus pull upon a member of the first mentioned device, a locking member in said first mentioned device adapted in the absence of operating means to lock said device against the movement which results when the door is opened, an arm controlling said locking device which extends into the path of one of the strikes on the elevator car, the first named member having a contact point which extends into the path of the yieldable strike extending to the vicinity of the control lever in the elevator car, said control lever, and movable detents arranged alongside of said control lever and adapted to be projected into and withdrawn from the path of said control lever.

2. The combination, with an elevator car, the controller in said car, the shaft within which the car operates, and the doors to said elevator shaft, of a strike yieldingly mounted on the car, a lock projectable into the path of movement of the car controller to limit the movement thereof, connections between said lock and said strike, a lever mounted adjacent the shaft doorway and adapted to engage said strike to move the same, intermediate connections between the door of said doorway and said lever whereby movement of the door from and to its closed position will move said lever, a lock movably engaging said lever to restrain the movement of the lever and thereby restrain the opening movement of the door, an operating member for said lock projected into the shaft, and a strike carried by the car in position to engage said operating lever and retract the lock only when the first mentioned

strike is in position to be actuated by the lever.

3. In a safety attachment for elevators, a locking device comprising a frame, a pivoted ratchet-faced sector, a rock-shaft mounted adjacent to said sector carrying a pawl which engages with said ratchet-face at one end and an arm at the other end, a spring adapted to normally hold the pawl into engagement with the ratchet-faced sector, connections operated by the elevator door arranged to move said sector-shaped rack when the pawl is disengaged, and means carried by the elevator car for disengaging said pawl.

In witness whereof, I, have hereunto set my hand and seal at Indianapolis, Indiana, this twenty-ninth day of December, A. D. one thousand nine hundred and nine.

HARRY W. McNAUGHT. [L. S.]

Witnesses:
CHESTER BRADFORD,
THOMAS W. McMEANS.

J. KULP.

SAFETY DEVICE FOR ELEVATORS.

APPLICATION FILED DEC. 30, 1908.

973,518.

Patented Oct. 25, 1910.

2 SHEETS—SHEET 1.

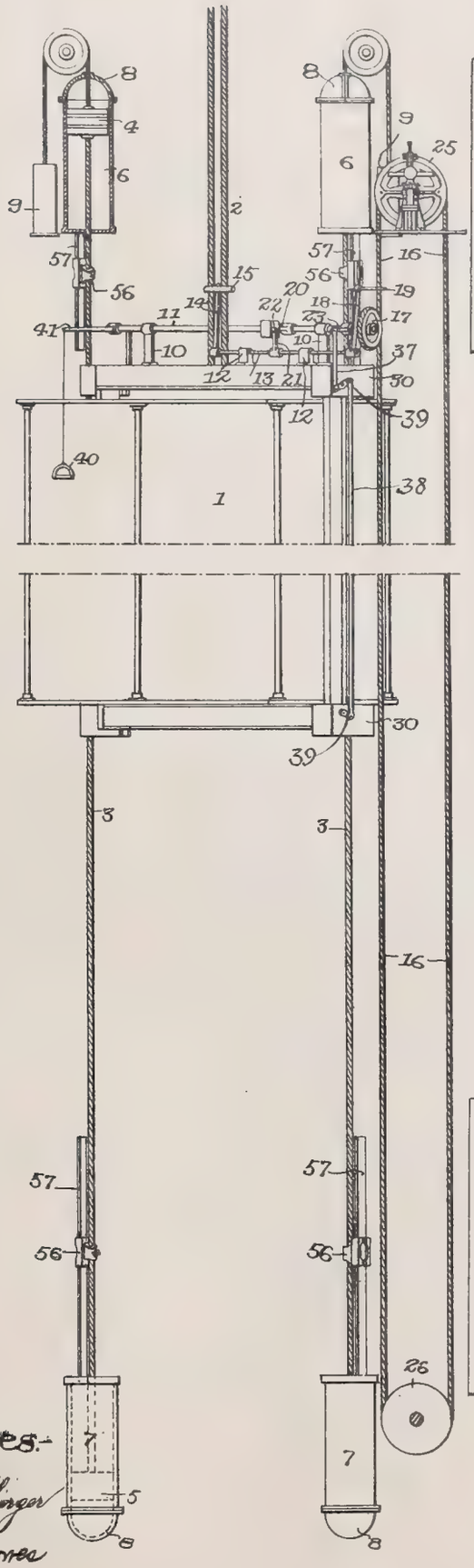


Fig. 1.

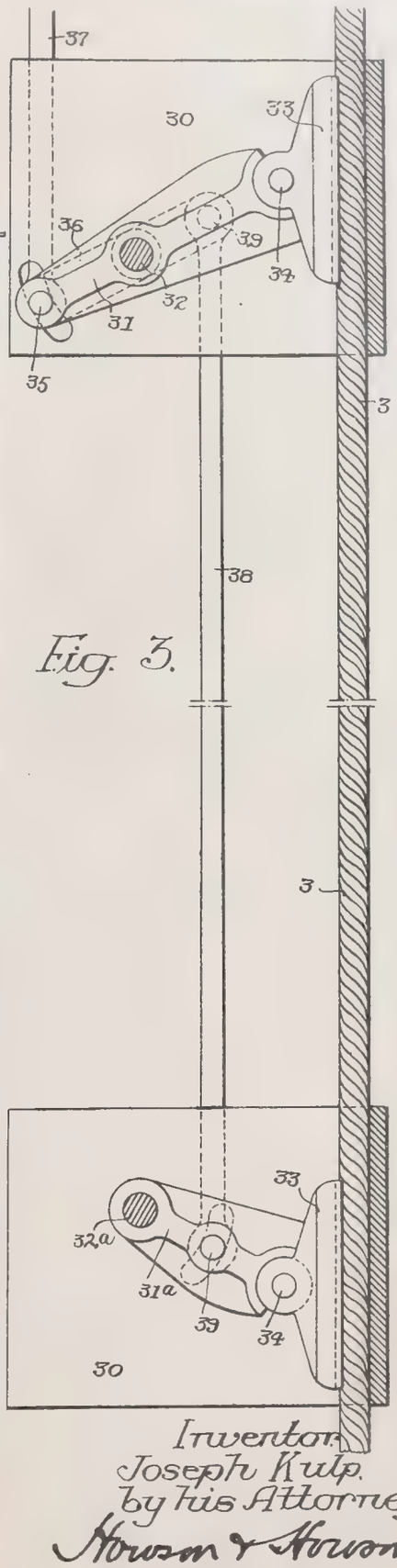


Fig. 3.

Witnesses:-

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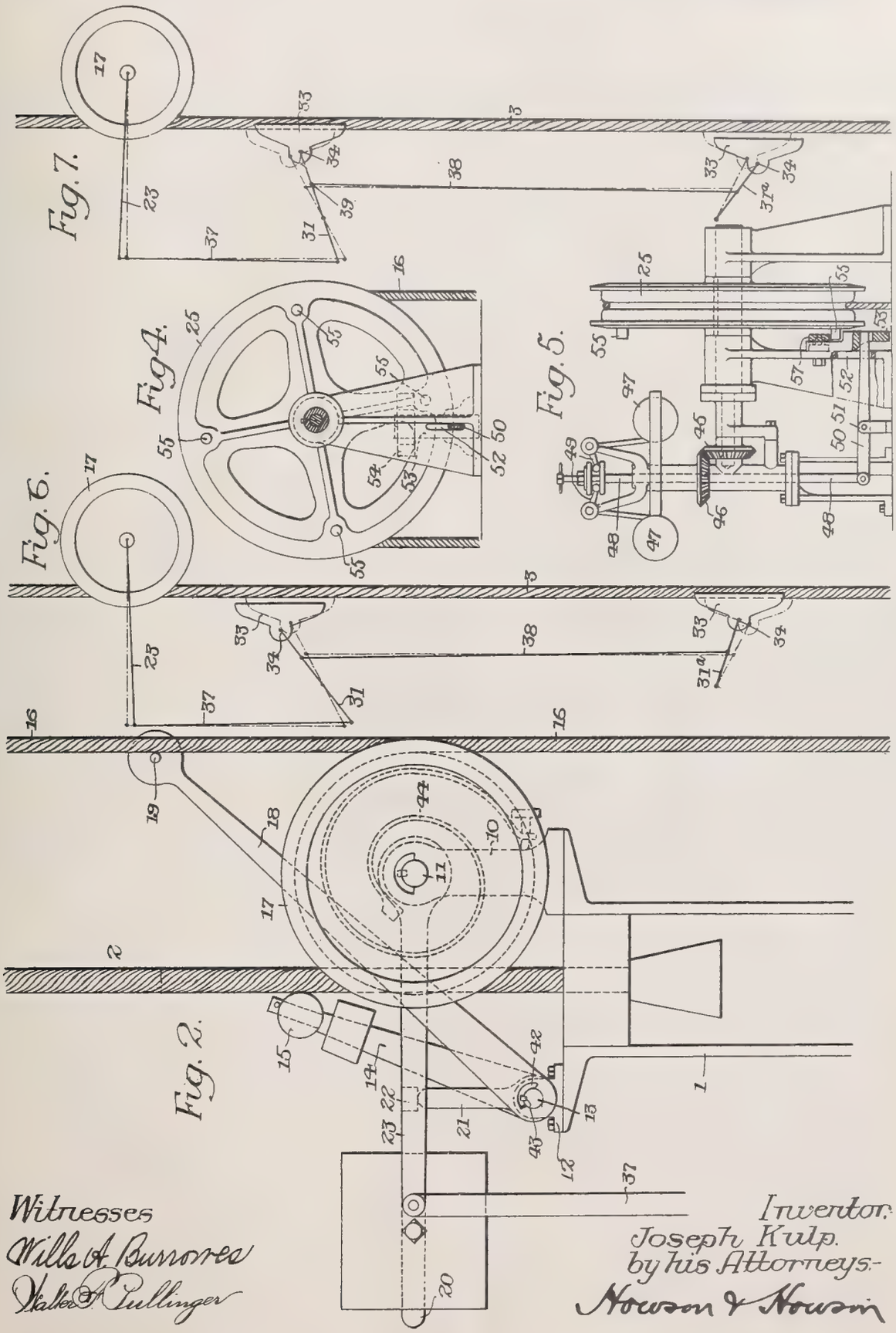
2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

JOSEPH KULP, OF JERSEY CITY, NEW JERSEY, ASSIGNOR OF ONE-HALF TO ALFRED HAND, OF SCRANTON, PENNSYLVANIA.

SAFETY DEVICE FOR ELEVATORS.

973,518. Specification of Letters Patent. Patented Oct. 25, 1910.

Application filed December 30, 1908. Serial No. 469,999.

To all whom it may concern:

Be it known that I, JOSEPH KULP, a citizen of the United States, and a resident of Jersey City, New Jersey, have invented certain Improvements in Safety Devices for Elevators, of which the following is a specification.

My invention relates to elevators; and the object of my invention is to provide improved automatically operating safety devices that will serve to arrest the movement of the elevators should the cables or other part of the supporting means give way, or when its speed in either direction is accelerated beyond a predetermined limit.

My invention consists of certain improvements in the structures illustrated in the Hanford Patents, Nos. 397,912, and 703,127, dated February 19, 1889, and June 24, 1902, respectively, and the details of the same are fully shown in the accompanying drawings, in which:

Figure 1, is an elevation of an elevator, partly in perspective, showing the same suspended in a shaft, and illustrating the safety mechanism carried by the car and arresting means for coöperation therewith mounted in the upper and lower portions of the elevator shaft; Fig. 2, is an enlarged view, showing a side elevation of a part of such mechanism; Fig. 3, is an enlarged view of clutches employed in connection with my improved safety device; Fig. 4, is a view of the brake wheel over which the rope for actuating the clutches travels; the governor, and the means actuated by the governor for stopping said brake wheel; Fig. 5, is a side elevation, partly in section of the structure shown in Fig. 4, and Figs. 6 and 7, are diagrammatic views illustrating the operation of the brake shoes or clutches forming part of my invention.

In the drawings herewith, 1 represents a car adapted to travel in a suitable shaft; such car being supported by the usual cables 2 which are raised and lowered in any suitable or approved manner. Disposed in the shaft and arranged to pass through the car are what may be termed "standing cables" 3; such cables being connected to pistons 4 at the top and 5 at the bottom, which pistons are disposed in suitable cylinders 6 and 7, respectively. The cylinders are provided with covers 8, which may be termed vacuum caps. The pistons 5 in the lower cylinders 7 are normally disposed in the bottom of the same, while the pistons 4 in the upper cylinders 6 are normally disposed toward the top of the same, and the latter pistons are maintained in their position by weights 9.

The car is provided with suitable clutches mounted adjacent the roof and floor of the same, which clutches are for engagement with said standing cables and are more fully described hereinafter, and these clutches may be brought into action to arrest the movement of the car under certain conditions through the aid of the following described mechanism: Suitably journaled in bearings 10 on top of the car is a shaft 11, disposed to one side of the cables 2 supporting the car. On the opposite side of said cables and mounted in bearings 12 a little lower than the shaft 11, is a rock shaft 13 carrying an upwardly projecting arm 14, which may be weighted; such arm being provided with a movable cross piece 15, which lies against the supporting cables 2.

The elevator is equipped with the usual governor mechanism, the cable of which, indicated at 16, passes around a wheel or pulley 17 mounted on the shaft 11, and the rock shaft 13 carries at its outer end another arm 18 having a finger 19 in contact with said governor cable.

The shaft 11 is provided with a weighted lever 20, and is maintained in a normal position by means of an arm 21 on the shaft 13 which normally engages a projection 22 on the weighted lever 20, but may be tripped to allow said weighted lever to drop.

The shaft 11 carries an arm 23 to operate the clutch mechanism, and this arm is rendered active under the following conditions: Should one of the supporting cables 2 break, the movable cross-piece 15 engaging the same, which is pivotally mounted on the end of the arm 14, would turn on said arm; releasing it from its normal position and allowing it to throw over, which action would turn the rock shaft 13 in its bearings and cause the trip arm 21 to release the weighted lever 20 on the shaft 11 and allow the same to drop. This movement of the weight will cause said shaft 11 to turn in its

bearings, and will actuate one of the clutches to engage the standing cables through the medium of the arm 23. If the car is descending when such accident occurs, the standing cables will tend to buckle at the bottom and to pull down on the pistons 4 in the cylinders 6 at the top of the well, and as such pistons will tend to compress the air in the cylinders ahead of them besides being held back by a partial vacuum in said cylinders, due to the closed caps 8, the progress of the car will be arrested.

As before explained, the governor cable 16 passes over a pulley 17 on the end of the shaft 11, said pulley being normally non-rotative, and the cable runs freely over the pulleys 25 and 26 at top and bottom of the shaft; the former pulley being controlled by governor mechanism. Should accident to the operating machinery cause the car to accelerate its movement in either direction, such movement will cause the governor cable to increase the speed of the pulley 25 and this communicating to the governor will cause the latter to actuate means (more fully described hereinafter) to arrest the movement of said pulley 25 and the cable traveling over it. This stopping of the cable will cause the wheel or pulley 17 on the end of the shaft 11 to turn and actuate the mechanism before referred to, thereby producing the same conditions with regard to throwing the clutches into engagement with the standing cables, as is effected by the breaking of the hoisting cables. If such accelerated movement takes place when the car is ascending, the upper clutches will be thrown into contact with the standing cables, and the latter will be raised, lifting the pistons in the lower cylinders; the pistons compressing the air within the same besides being held back by a partial vacuum in said cylinders, due to the caps 8, and gradually stopping the car. When the accelerated movement takes place on the downward movement of the car, the lower clutches will be thrown into action and the standing cable will be lowered against the pressure exerted by the pistons in the upper cylinders. Should the governor cable break, the same result will be accomplished, as owing to the engagement of the finger 19 of the arm 18 carried by the rock shaft 13 with said governor cable, the release of the arm by the breaking of such cable will remove the trip arm 21 and permit the shaft 11 to turn, thereby throwing one set of the clutches into engagement with the standing cable.

The clutches are mounted at top and bottom of the car on both sides of the same; one set of the same being fully shown in the normally inactive position in Fig. 3, and in the operative positions in the diagrammatic views, Figs. 6 and 7; and these clutches are disposed in suitable housings 30, carried by the frame of the elevator at top and bottom of the same. The upper clutches comprise, in each instance, a lever 31 pivotally mounted at 32 and carrying a shoe 33 with a grooved face for engagement with the standing cable; such shoe being pivotally connected to the lever 31 at 34. Connected at 35 to a lever 36 disposed outside the housing and paralleling said lever 31, is a link 37, the other end of which is connected to the arm 23 carried by the shaft 11 on top of the car, and when this arm 23 is operated in the manner described, owing to any accident occurring in the operation of the car, one clutch of each set will be operated.

The lower clutches comprise, in each instance, a lever 31^a pivoted at 32^a and having a shoe 33 pivoted to said lever at 34 with a grooved face for engagement with the standing cable. This clutch is operated from the lever 36 by means of a link 38 connected at 39 to said levers.

In the diagram views, Figs. 6 and 7, the dotted lines represent the inactive positions of the clutches when the car is running under normal conditions; the full lines, Fig. 6, showing the position of the parts when the lower clutches are thrown into action; the upper clutches being out, and the full lines, Fig. 7, showing the position of the parts when the upper clutches are thrown into action; the lower clutches being out. When the arm 23 carried by the shaft 11 is raised, due to accelerated upward movement of the car, the upper clutches will be thrown into action and the lower clutches will be thrown out, as shown in Fig. 7, and when said arm is operated due to accelerated downward movement of the car, the lower clutches will be operated in the manner described and the upper clutches will be thrown out, as shown in Fig. 6.

In order that the clutches may be under the control of the elevator attendant and operable by hand, I provide a hand pull 40 extending through the roof of the car, the upper end of which is connected to a lever 41 attached to the rock shaft 11.

Lost motion is provided for between the shaft 13 and the finger 19 of the arm 18 lying against the governor cable 16, so that the mechanism may operate should one of the hoisting cables break, without affecting the governor or its cable. This is accomplished by slotting the hub of the arm 18 at 42, and providing the shaft 13 with a lug 43 for engagement with the end walls of said slot. Similar provision for lost motion is made between the hub of the weighted lever 14 and the shaft 13; the hub of the weighted lever 20 and the shaft 11; the hub of the lever 41 and said shaft 11, and the hub of the pulley 17 and said shaft 11. The pulley 17

is also provided with a coiled spring 44 designed to return it to normal position after it has been operated for any purpose.

It will be understood that the clutches 33 and the mechanism shown at one side of the car for automatically operating said clutches should accidents occur owing to breakage of the cables, or if the speed of the car acquire undue acceleration, are duplicated on the other side of the elevator illustrated in Fig. 1, but it has been thought unnecessary to indicate such duplication on said view of the drawing. The governor cable being on one side of the car only, there is but a single operating means controlled thereby.

In Fig. 5, the governor mechanism is shown on a larger scale. The shaft carrying the sheave or pulley 25 has at its outer end a bevel gear 45, meshing with a bevel gear 46 through which the speed governor receives its motion. When the downward speed of the car becomes too great for safety, the balls 47 of the governor are thrown outward by centrifugal force and acting upon a vertical rod 48, through their arms 49, depress said rod which is connected at its lower end to one end of a lever 50, pivoted at 51. The opposite end of this lever extends through a slot 52 in the support for the bearings of the shaft carrying said sheave or pulley 25 and into engagement with a vertically movable member 53 free to slide in guides 54. The sheave or pulley 25 is provided on its face with pins 55, which serve as stops when the member 53 is raised by the lever 50 into their path. Such stoppage of the sheave or pulley 25 will cause the cable passing over the same to move the pulley 17, and such movement of the pulley will actuate the shaft 11 and the coacting mechanism for arresting the movement of the car in the manner described. A further means of arresting downward movement of the car consists of stops 56 carried by the standing cables 3 near the top and bottom of the elevator shaft or well. These stops are guided by suitable rods 57 extending upwardly from the lower cylinders and downwardly from the upper cylinders, and should the car fall into the well, it will engage these stops and exert a pull on the standing cables against the force exerted by the pistons in the upper cylinders and the weights, thereby stopping the car; the lower portions of the standing cables buckling.

While I have shown certain devices for accomplishing the results sought to be attained, I do not wish to be limited to the precise construction and arrangement of the parts of the mechanism forming the subject of my invention.

I claim:

1. The combination, in an elevator safety device, of a car, a pair of standing cables suitably connected at top and bottom of the well in which said car operates, clutch mechanism at top and bottom of the car normally inactive but disposed for engagement with said standing cables, means on top of the car for controlling said clutches, one of said clutches being arranged for engagement with said standing cables when an accident occurs with the car moving in one direction and the other of said clutches being arranged for engagement with said standing cables when an accident occurs with the car moving in the opposite direction, said means being normally in the inactive position, and means for throwing said controlling means into action under varying conditions.

2. In an elevator safety device, the combination of an elevator car, a pair of standing cables suitably connected at top and bottom of the well in which said car operates, clutch mechanism carried at top and bottom of the car normally inactive but disposed for engagement with said standing cables, a shaft on top of the car controlling said clutches, one of said clutches being arranged for engagement with said standing cables when an accident occurs under certain conditions with the car moving in one direction and the other of said clutches being arranged for engagement with said standing cables when an accident occurs under certain conditions with the car moving in the opposite direction, said shaft being normally in an inactive position, and means controlled by said shaft for throwing said clutches into action under varying conditions.

3. The combination, in a safety device for elevators, of a car, a pair of standing cables passing through said car, a shaft mounted on top of said car, a governor, a cable for operating said governor, a wheel mounted on said shaft around which the governor operating cable passes and by which it is moved vertically, clutching mechanism arranged to coöperate with the standing cables, and means for operating said clutching mechanism by the turning of said wheel.

4. The combination, in an elevator safety device, of a car, a hoisting cable therefor, a pair of standing cables, housings carried by said car through which said cables pass, pivoted arms at top and bottom of said car having clutch shoes for engagement with said cables within said housings, means for operating said clutch carrying arms including a weighted lever, and means carried by the car and operable by the breaking of the hoisting cable for throwing said mechanism into action.

5. In an elevator safety device, the combination of a car, having the usual operating mechanism including a governor and a governor cable, a pair of standing cables mounted in the elevator shaft, housings car-

ried by said car through which the cables pass, pivoted arms at top and bottom of said car having clutch shoes for engagement with said cables in the housings, and means carried by the car including a weighted lever for throwing said clutch carrying arms into action by the breaking of the governor cable.

6. The combination, in an elevator safety device, of a car, a pair of standing cables, clutches for engagement therewith, means for operating said clutches, cables supporting the car, a lever carried by the clutch operating mechanism, and a pivoted arm mounted on said lever and in engagement with said supporting cables, the release of said arm by the breaking of one of the supporting cables serving to throw the clutch operating mechanism into action.

7. In an elevator safety device, the combination of a car, a pair of standing cables mounted in the shaft or well in which said car travels, clutches carried at top and bottom of the car for engagement with said standing cables, means for operating said clutches, one of said clutches being arranged for engagement with said standing cables when an accident occurs with the car moving in one direction and the other of said clutches being arranged for engagement with said standing cables when an accident occurs with the car moving in the opposite direction, a governor, a cable operating the same, and means carried by the clutch operating mechanism for moving said cable, said means serving to throw the clutching mechanism into action should the movement of the governor cable be arrested.

8. The combination, in safety devices for elevators, of cylinders mounted at top and bottom of the shaft in which the elevator travels, pistons in said cylinders, standing cables in the shaft to which said pistons are connected, the pistons in the upper cylinders being disposed near the upper part of the same while the pistons in the lower cylinders are adjacent the bottom of the same, clutches mounted on the car for engagement with said standing cables, the movement of the car after such engagement tending to compress the air within the cylinders and arrest such movement while the pistons are also retarded by the vacuum created by their movement, and means for operating said clutches.

9. In an elevator safety device, the combination of a car, standing cables mounted in the shaft, stops fixed to said cables to arrest the downward movement of the car, and guides for said stops.

10. In an elevator safety device, the combination of a car having the usual operating mechanism including hoisting cables, a governor and a governor cable, cylinders mounted at the top and bottom of an elevator shaft, pistons in said cylinders, standing cables connected to said pistons, and clutching mechanism on the car for engagement with said standing cables under conditions caused by accident to the hoisting cables, the governor cable, or accelerated movement of the car in either direction, such movement affecting the governor cable.

11. In an elevator safety device, cylinders mounted at top and bottom of an elevator well, standing cables extending between said cylinders, pistons in said cylinders connected to said cables, and caps carried by said cylinders through which the cables pass, said caps being substantially air-tight and serving to create a partial vacuum and thereby assist in retarding the movement of the cables in connection with the pressure exerted by the pistons within said cylinders to which said cables are connected.

12. In an elevator safety device, the combination of a car, a series of standing cables mounted in the shaft or well in which said car travels, clutches for engagement with said standing cables, a governor, a cable for operating the same, a wheel around which said cable passes and by which it is moved, a pulley moved by said cable, said pulley having a series of pins on its face, a lever, and a sliding member operated by said lever and brought into position to engage one of said pins and arrest the movement of the pulley and the governor cable, the wheel for operating said cable being moved by such action and actuating the clutches.

13. In an elevator safety device, the combination of a car, standing cables mounted in the shaft, stops fixed to said cables to arrest the movement of the car, and guides for said stops.

14. In an elevator safety device, cylinders mounted at top and bottom of an elevator well, standing cables extending between said cylinders, clutches for engaging the car with said cables, pistons in said cylinders connected to said cables, means for maintaining said cables in a taut condition, and caps carried by said cylinders, said caps being substantially air-tight and serving to create a partial vacuum and thereby assist in retarding the movement of the cables when the car is clutched to the same.

15. The combination, in a safety device for elevators, of an elevator car, a pair of standing cables disposed in the well for said car and passing through the same, a shaft mounted on top of said car, a governor, a cable for operating said governor, a pulley mounted on said shaft around which the governor operating cable passes and by which said cable is moved vertically, said pulley being normally non-rotative, clutching mechanism carried by the car and ar-

ranged to coöperate with the standing cables, means for operating said clutching mechanism upon turning of said pulley, other means for operating said clutches independently of said governor cable and pulley, and provision for lost motion between the operating parts to avoid the actuation of all when any one is operated.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

JOSEPH KULP.

Witnesses:
MURRAY C. BOYER,
JOS. H. KLEIN.

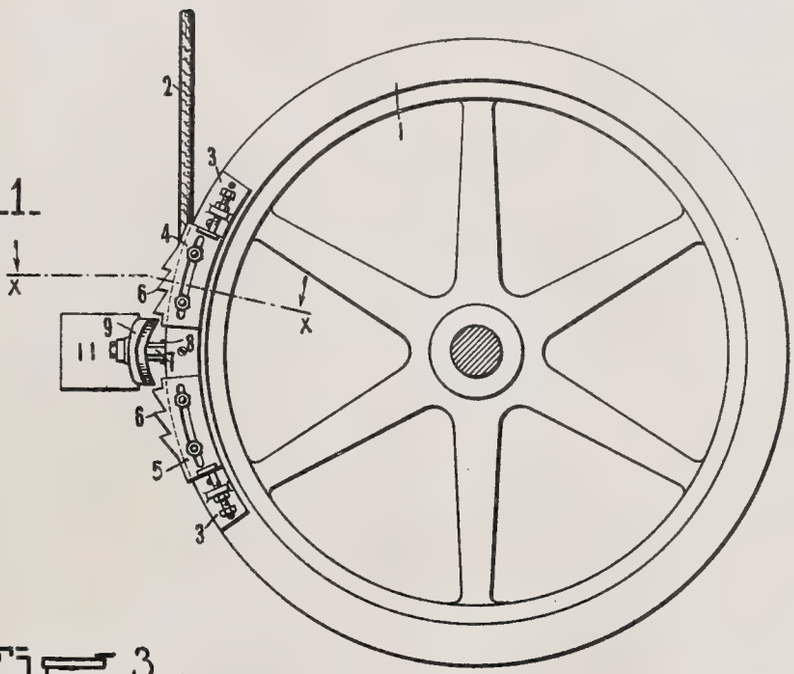
H. G. HILLMAN.

SAFETY DEVICE.

APPLICATION FILED DEC. 1, 1909.

981,423. Patented Jan. 10, 1911.

Fig. 1.



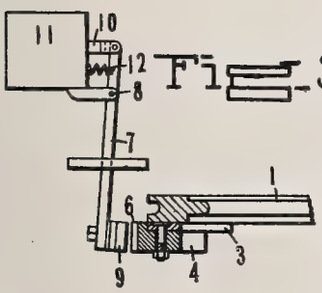


Fig. 3.

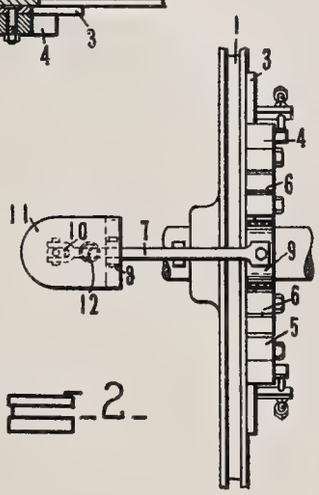
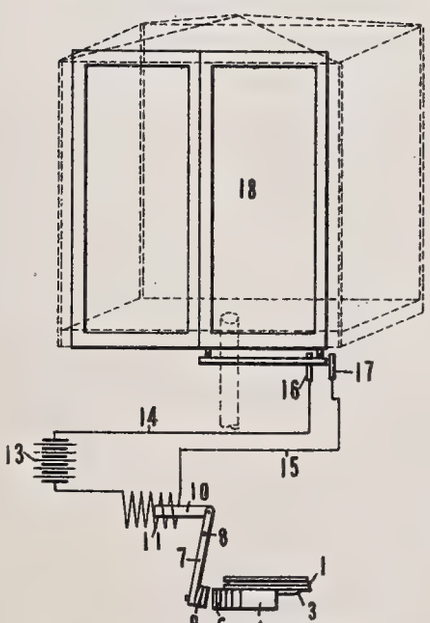


Fig. 2.

Fig. 4.



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SAFETY DEVICE.

981,423. Specification of Letters Patent. **Patented Jan. 10, 1911.**

Application filed December 1, 1909. Serial No. 530,798.

To all whom it may concern:

Be it known that I, HENRY GEORGE HILLMAN, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Safety Devices, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to safety devices and with regard to the more specific features thereof, to devices for locking the power controlling mechanism of elevators and the like.

One of the objects thereof is to provide a practical and reliable device of the above character.

Another object thereof is to provide a durable device adapted to automatically lock the power controlling mechanism of an elevator in neutral position in case the elevator doors are opened while the car is at rest.

A further object thereof is to provide a simple, inexpensive and efficient means adapted, should the doors be opened, to automatically prevent the operator increasing the speed of the elevator, yet enabling him to decrease the speed thereof or bring the same to rest.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings wherein is illustrated one of the various possible embodiments of this invention, Figure 1 is a front elevation of a wheel adapted to actuate the controlling mechanism of elevators, with the safety locking device arranged in operative relation thereto. Fig. 2 is a side elevation of the same. Fig. 3 is a cross-section taken on line *x*—*x* of Fig. 1, and Fig. 4 is a diagrammatic view showing the electric connections of the solenoid by which the latch is operated, when the elevator doors are opened.

Similar reference characters refer to similar parts throughout the several views of the drawing.

Now referring to the drawings, 1 denotes a wheel of any suitable construction which may be secured, either directly or indirectly, to a valve adapted to control the admission and exhaust of fluid to the plunger cylinder of a hydraulic elevator, and attached to said wheel is a cable 2 which may be connected to a lever or other operating device located in the elevator car. Rigidly secured to the rim of the wheel is a member 3, having adjustably attached thereto spaced members 4 and 5, each provided with ratchet teeth 6 upon its outer, circumferential surface. These members are disposed upon either side of the neutral point in the wheel's periphery and the teeth of both incline toward said neutral point.

It may here be noted that the expression "neutral position" is used in this specification and claims to indicate the position assumed by the valve or other controlling mechanism, when the elevator is at rest and that with reference to the valve wheel, the "neutral point" is that point in the circumference thereof which will be opposite the latch or other locking means when the controlling mechanism is in "neutral position".

A lever 7, pivoted at 8, has secured to one end thereof a double toothed latch or pawl 9 which, when the controlling mechanism is in neutral position, is adapted to assume a position between the opposing ends of the members 4 and 5 and, when the controlling mechanism is out of neutral position, to engage with whichever of the teeth 6 is in alinement therewith. Pivotally secured to the opposite end of the lever 7 is a plunger 10 adapted to be drawn within the solenoid 11 and a spring 12 is provided to force the lever in the opposite direction when the solenoid circuit is broken.

Fig. 4 shows, diagrammatically, the circuit in which the solenoid 11 is connected. 13 denotes an electric battery and 14 and 15 the wire connections leading from the battery and solenoid to the contact members 16 and 17. The specific form of switch employed to close the battery circuit is unimportant and forms no part of the present invention. It is, therefore, deemed sufficient to state that when the doors 18 of the elevator or elevator shaft, as the case may be, are closed, the battery circuit is open and the solenoid unenergized and that upon the doors being opened to the slightest degree

the circuit is immediately closed and the solenoid excited.

Having described one embodiment of my invention, the operation thereof follows: First assuming that the elevator doors are closed, the wheel 1 may be actuated by the operator to attain the desired elevator speed. If, however, while the elevator car is stationary, the doors are opened, the solenoid becomes energized and retracts the plunger 10 whereby the latch 9 is projected into the space provided therefor between the inner ends of the members 4 and 5, locking the wheel against rotation and preventing the operator from starting the elevator in either direction. The members 4 and 5 are adjusted so as to allow sufficient clearance between the inner ends thereof and the latch 9 to readily compensate for any leakage of the pistons or valves. When the doors are again closed by the operator the solenoid circuit is broken, whereupon the spring 12 forces the plunger end outwardly, withdrawing the latch 9 from its locking position and permitting the operator to again start the elevator. If, on the other hand, the doors 18 are opened while the elevator is moving, the circuit will be closed as before, but as, under these conditions, the mechanism is not in neutral position, the latch 9 will be forced into engagement with one of the ratchet teeth 6, locking the wheel so that it cannot be moved by the operator to increase the speed of the elevator, but may be rotated to reduce the speed thereof, or to bring the same to rest, whereupon the parts will be securely locked as hereinbefore described. It is to be noted that instead of a wheel, a lever might be used and the locking device secured thereto in any convenient manner. It is to be understood that while certain advantages are present in the embodiment herein described wherein the latch is put in operation when the circuit is closed by the opening of the elevator doors, the invention is not to be limited to such an arrangement, for if desired the latch may be thrown into engagement mechanically, as by a spring, and released by the solenoid. In the latter case the circuit of the solenoid would be closed when the doors are shut.

It will be seen from the foregoing description that this invention is well adapted to attain the objects hereinbefore set forth in an efficient and reliable manner; that it is characterized by a minimum of parts liable of injury under the exigencies of usage; and that said parts are inexpensive to construct and install.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In apparatus of the character described, in combination, an elevator, doors, means for controlling the operation of said elevator adapted to be moved to either side of a neutral position, and means adapted, upon said doors being opened, to lock said controlling means in all positions thereof against movement in either direction away from said neutral position and permit a movement of said controlling means toward said neutral position.

2. In apparatus of the character described, in combination, an elevator, doors, means for controlling the operation of said elevator adapted to be moved away from a neutral position, and means adapted, upon said doors being opened, to lock said controlling means in all positions thereof against movement away from said neutral position and permit a movement of said controlling means toward said neutral position.

3. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a circuit adapted to be opened and closed by the movement of the doors, a rack associated with said controlling means, and means adapted to engage said rack to allow movement of the controlling means toward the neutral position but not away therefrom when the doors are open.

4. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a circuit adapted to be closed when said doors are open, a rack associated with said controlling means, a solenoid, and means connected with the core of said solenoid adapted to engage said rack and allow movement of the controlling means toward the neutral position but not away therefrom when said circuit is closed.

5. In apparatus of the character described, in combination, an elevator, doors, means for controlling the operation of said elevator adapted for movement to either side of the neutral position, a ratchet associated with said controlling means, and a pawl adapted,

upon said doors being opened, to engage said ratchet to lock said controlling means in all positions thereof against movement away from its neutral position and permit a movement of said controlling means toward said neutral position.

6. In apparatus of the character described, in combination, an elevator, doors, means for controlling the operation of said elevator adapted for movement to either side of a neutral position, a ratchet associated with said controlling means, and a pawl adapted, upon said doors being opened, to engage said ratchet and permit movement of the controlling means toward the neutral position and lock the same against movement in an opposite direction.

7. In apparatus of the character described, in combination, an elevator, doors, means for controlling the operation of said elevator adapted for movement to either side of a neutral position, a ratchet associated therewith and provided with teeth inclining toward a predetermined point from both sides thereof, and a pawl adapted, upon said doors being opened, to engage said ratchet whereby recession of said controlling means in either direction away from its neutral position is prevented.

8. In apparatus of the character described, in combination, an elevator, doors, means for controlling the operation of said elevator adapted for movement to either side of a neutral position, a ratchet associated therewith and provided with teeth inclining toward a predetermined point from both sides thereof, a pawl adapted to engage said ratchet, and magnetic means adapted to actuate said pawl upon said doors being opened.

9. In apparatus of the character described, in combination, an elevator, doors, means for controlling the operation of said elevator adapted for movement to either side of a neutral position, a ratchet associated therewith comprising two sets of teeth, the teeth of each set being oppositely disposed with respect to those of the other and a pawl adapted, upon said doors being opened, to engage said ratchet whereby recession of said controlling means in either direction away from its neutral position is prevented.

10. A safety lock for elevators, comprising in combination, a member having a neutral notch and provided with ratchet teeth disposed on opposite sides of and inclined toward said notch, and a latch adapted to be brought into interlocking contact with said member in all positions of the latter.

11. A safety lock for elevators, comprising in combination, a member having a neutral notch and provided with ratchet teeth disposed on opposite sides of and inclined toward said notch, and a latch provided with oppositely disposed detents adapted to be brought into interlocking contact with said member in all positions of the latter.

12. A safety lock for elevators, comprising in combination, a member having a neutral notch and provided with ratchet teeth disposed on opposite sides of and inclined toward said notch, a latch provided with oppositely disposed detents adapted to be brought into contact with said member in all positions of the latter, and magnetic means adapted to actuate said latch.

13. A safety lock for elevators, comprising in combination, an elevator valve wheel, a member secured thereto having a neutral point and provided with ratchet teeth disposed upon opposite sides of and inclined toward said point and an automatically actuated pawl adapted to engage said member.

14. A safety lock for elevators, comprising in combination, an elevator valve wheel adapted to turn beyond a neutral position in either direction, a member secured thereto having a neutral notch and provided with ratchet teeth disposed upon opposite sides of and inclined toward said notch, and a pawl adapted, with said wheel in its neutral position, to engage the sides of said notch to prevent rotation of said wheel.

15. A safety lock for elevators, comprising in combination, an elevator valve wheel adapted to turn beyond a neutral position in either direction, a member secured thereto having a neutral notch and provided with ratchet teeth disposed upon opposite sides of and inclined toward said notch, and a pawl adapted, with said wheel in its neutral position, to engage the sides of said notch to prevent rotation of said wheel, said notch and said pawl being relatively proportioned to interfit with a predetermined amount of clearance in the direction of rotation of said wheel.

16. A safety lock for elevators, comprising in combination, an elevator valve wheel adapted to turn beyond a neutral position in either direction, a member secured thereto having a neutral notch and provided with ratchet teeth disposed upon opposite sides of and inclined toward said notch, and a pawl adapted, with said wheel out of neutral position, to engage said teeth to prevent further recession of said wheel from said position.

17. A safety lock for elevators, comprising in combination, an elevator controlling means adapted for movement to either side of a neutral position, a member rigidly secured thereto, two ratchet members slidably supported by said first member, each of said ratchet members being adjustable toward and away from a neutral point therebetween and each having teeth inclining toward said neutral point, a latch adapted, with said controlling means in neutral

position, to be received between the opposing inner ends of said ratchet members and, with said controlling means out of neutral position, to be thrown into engagement with one of said teeth, and means adapted to actuate said latch.

18. In elevating apparatus, in combination, controlling means associated with an elevator, doors, a ratchet member secured to said controlling means, a latch and a solenoid connected in a circuit adapted to be closed when said doors are opened whereby said latch will be thrown into engagement with said ratchet, said ratchet having teeth pointed toward a neutral point whereby the controlling means may be moved toward a neutral position and locked against movement in an opposite direction.

In testimony whereof I affix my signature, in the presence of two witnesses.

HENRY G. HILLMAN.

Witnesses:
R. S. Blair,
H. M. Seamans.

H. G. HILLMAN.

ELEVATOR SAFETY DEVICE.

APPLICATION FILED FEB. 18, 1910.

981,424. Patented Jan. 10, 1911.

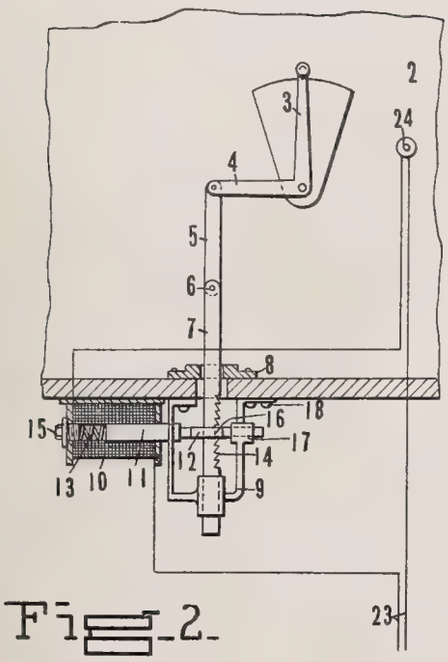

Fig. 2.

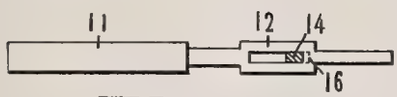

Fig. 3.

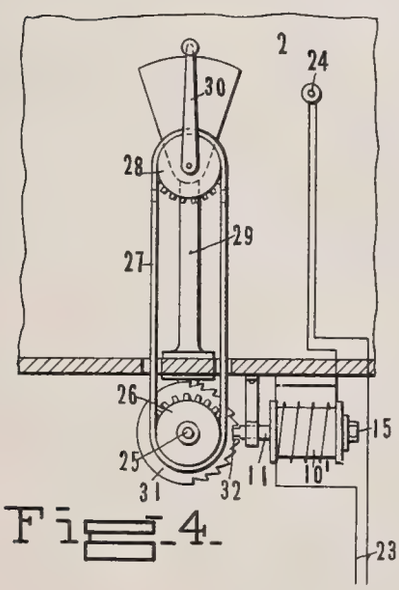

Fig. 4.

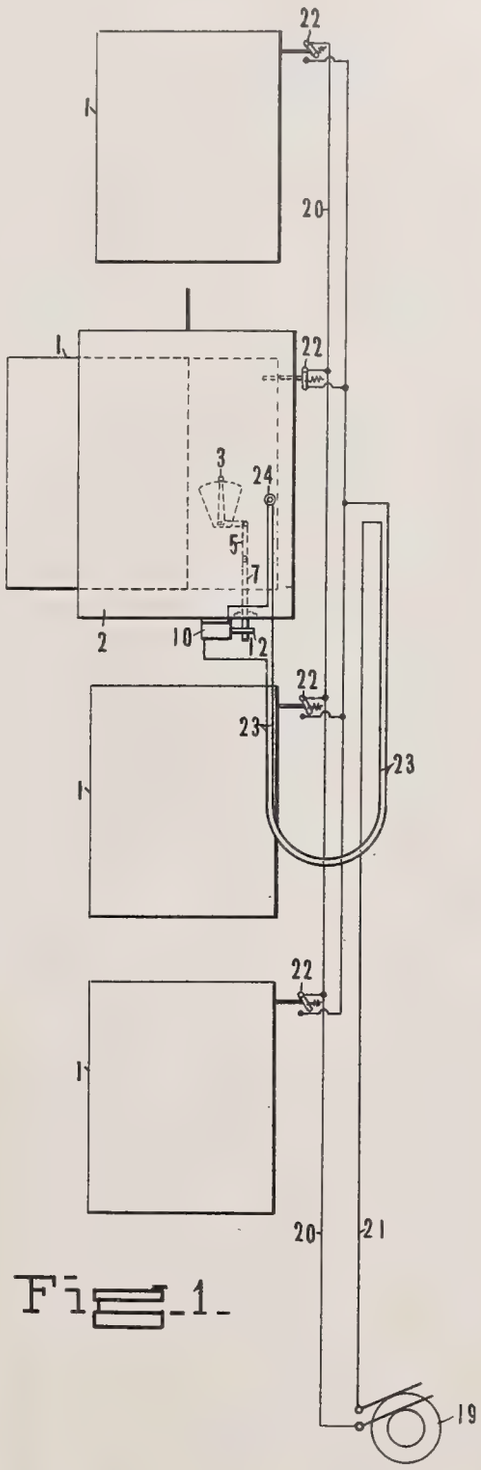

Fig. 1.

WITNESSES:

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UNITED STATES PATENT OFFICE.

HENRY GEORGE HILLMAN, OF NEW YORK, N. Y., ASSIGNOR TO JOHN TEFFT CLARKE, OF NEW YORK, N. Y.

ELEVATOR SAFETY DEVICE.

981,424. Specification of Letters Patent. Patented Jan. 10, 1911.

Application filed February 18, 1910. Serial No. 544,612.

To all whom it may concern:

Be it known that I, HENRY GEORGE HILLMAN, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Elevator Safety Devices, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to safety devices for elevators, and with regard to the more specific features thereof, to devices for locking the power controlling mechanism in its neutral position.

One of the objects of the present invention is to provide a practical and reliable device of the above character.

Another object thereof is to provide an improved automatic mechanism for engaging the controlling mechanism of an elevator and holding the same in its neutral position, in case any of the elevator doors on the various floors are opened while the car is at rest.

A further object of the present invention is to provide a novel, simple and efficient means adapted to prevent the operator from increasing the speed of the car should any of the doors be opened while the car is in motion, and yet permitting the operator to return the controlling mechanism to neutral position and bring the car to a stop at any point.

A further object of the present invention is to provide an elevator car with a safety device at a point that will in no way interfere with the space within the car and yet act directly upon the controlling means.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings wherein is illustrated two of the various possible embodiments of the invention,—Figure 1 is a diagrammatic view of the entire system, illustrating one embodiment of the invention as applied thereto; Fig. 2 is a detail view, showing the safety device; Fig. 3 is a detail view; and Fig. 4 is a modification, showing the device applied to a different form of controlling mechanism.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to the drawing in detail, 1 denotes the several doors on the various floors of an elevator shaft, in which is positioned a car 2 adapted to operate in a well-known manner. This car 2 is provided with a controller handle 3, which is adapted to control the movement of the car either up or down, through suitable mechanism which is not shown in the drawings, for the sake of clearness. The controller handle 3 is in the form of a bell crank lever; that is, having an arm 4 at right angles thereto, to which is connected a link 5 jointed at 6 and adapted to pass through the bottom of the car. The joint 6 is for the purpose of enabling the lower part 7 of the link 5 to reciprocate in a vertical line through suitable guiding means 8 and 9 secured to the floor of the car above and below the same, respectively.

Secured to the under side of the car is a solenoid 10 provided with a core 11 adapted to reciprocate at right angles to the link 7. This core 11 is provided with an extension 12 in the form of a stirrup, adapted to surround the link 7, as clearly shown in Fig. 3. Within the solenoid 10 is a spring 13 normally tending to force the core 11 outwardly, to prevent the stirrup 12 from normally engaging with a rack 14 on the link 7. The tension of this spring may be adjusted as by means of a nut 15 at the end of the solenoid.

The rack 14 on the link 7 is provided with a central recess 16, the teeth on the opposite sides of which point in opposite directions and toward each other, so that if the stirrup 12 engages the rack while the link is depressed, for example, the controller being to one side of a neutral position, the operator may return the controller 3 to neutral position but cannot increase the speed of the car. The end of the stirrup 12 is adapted to pass through a suitable recess 17 in the upper part of the guide 9, secured to the floor of the car at 18 whereby these parts 7 and 12 are always held in a position to be actuated in the easiest possible manner.

A suitable source of electricity 19 is connected by means of main wires 20 and 21 passing up to the top of the elevator shaft with a suitable switch 22 opposite each door adapted to be opened when the door is closed, as shown in Fig. 1 at the "first floor," and automatically closes the circuit when the door is opened, as shown by the position of the door on the "third floor." The closing of the circuit at this point will permit the current to pass from one of the main wires across to the other through a flexible cable 23 connected with the car in a well-known manner, thence through the solenoid 10 and a switch or push button 24 within the car, back through the flexible cable 23 to the source of electricity 19. It is thus seen that when any door is opened, the solenoid 10 is actuated to draw the stirrup 12 into engagement with the rack 14 on the link 7, to lock the controller in neutral position or to engage it in such a manner as to permit a movement of the controller to only that position. The button 24 is for the purpose of breaking the circuit, if the operator should, for any reason, desire to move the car while the door is open.

The operation of this device is substantially as follows: Assuming all of the doors to be closed, the circuit will of course be broken, the solenoid deënergized, the core of which, under the action of the spring 13, is forced outwardly so that the stirrup carried thereby in no way interferes with the movement of the controller. As the car approaches the floor at which it is desired to stop, the operator frequently starts to open the door before the car is brought to a standstill. The instant the door is opened sufficiently to allow the switch 22 to act, the circuit is closed at that point, which energizes the solenoid 10, as above described, and immediately draws the stirrup 12 into engagement with the rack 14 to prevent a further movement thereof, except toward the neutral position. The controller remains locked in this position until the door is closed, breaking the circuit at the switch 22, unless for some reason the operator desires to press the button 24 and holds the same in pressed position while he starts the car. Such circumstances are, of course, unusual and in practice it is always inadvisable to break the current in this manner, as it would defeat one of the objects of the present invention.

Refer now to the modification of the device shown in Fig. 4: In some forms of elevators the controlling mechanism is beneath the floor of the car, the operating handle alone being within the car. In the case herein shown the controlling mechanism 25 is mounted beneath the body of the car and is provided with a sprocket wheel 26 connected by means of a chain 27 with a similar wheel 28 mounted on a suitable standard 29 within the body of the car. An operating handle 30 is provided, and it is assumed that at least a half revolution is required to bring the car into full motion. The solenoid 10′ beneath the car is connected with a circuit and source of electricity 19 as above described and acts in a somewhat similar manner on the opening and closing of the doors on the various floors of the shaft. On the same shaft with the controlling means 25 is mounted a wheel 31, part or all of which, if desired, is divided into a rack construction, provided with a central recess 32, the teeth on the opposite sides of which point toward the recess so that the core of the solenoid, when actuated, is permitted to engage either the central recess 32 or the teeth at opposite sides thereof, in a manner to permit a movement of the wheel 31 to neutral position. The operation of this device is substantially the same as that above described and need not be here repeated.

It may here be noted that the expression "neutral position" is used in the specification and claims to indicate the position assumed by the controlling mechanism when the elevator is at rest; and with reference to the rack on the link 7, the neutral point is that point in which the locking means will engage when the controlling mechanism is in neutral position.

It will thus be seen from the foregoing description that this invention is well adapted to attain the objects hereinbefore set forth in an efficient and reliable manner, it is characterized by a minimum number of parts liable to injury under the exigencies of usage, and that the said parts are inexpensive to construct and install. It is also to be noted that a great saving of space is accomplished by securing the safety device above described to the exterior of the car.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means for controlling the operation of said car adapted

to be moved from an operative to a neutral position, and means carried beneath the body of the car adapted upon said doors being opened to allow movement of the controlling means toward said neutral position but not away therefrom.

2. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, a controller within the car adapted to be moved to either side of a neutral position, and means directly connected with said controller, upon said doors being opened, to allow movement of the controlling means toward the neutral position but not away therefrom.

3. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, an electric circuit, and means carried beneath the car controlled by the opening and closing of said circuit adapted to allow movement of the controlling means toward the neutral position but not away therefrom.

4. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means for controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a circuit, means associated with the doors for opening and closing said circuit, and means carried by the car controlled through said circuit adapted to allow movement of the controlling means toward the neutral position but not away therefrom when said doors are open.

5. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a circuit, and locking means carried beneath the body of the car in said circuit controlled by the opening and closing of the doors adapted to allow movement of the controlling means toward the neutral position but not away therefrom when the doors are open.

6. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a circuit adapted to be opened and closed by the movement of said doors, a rack operatively associated with said controlling means and movable therewith, and means secured to the bottom of the car, controlled by said circuit, adapted to allow movement of the controlling means toward the neutral position but not away therefrom when said doors are open.

7. In an apparatus of the character described, in combination, an elevator car, doors at the several floor, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a circuit adapted to be opened and closed by the movement of said doors, locking means operatively associated with and movable by said controlling means, a solenoid secured to the bottom of said car in said circuit, and means controlled thereby for engaging said locking means adapted to allow movement of the controlling means toward the neutral position but not away therefrom when said doors are open.

8. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a normally open circuit adapted to be closed when said doors are open, and locking means carried beneath the body of said car adapted to be actuated when said doors are open to allow movement of the controlling means toward the neutral position but not away therefrom.

9. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a normally open circuit adapted to be closed when said doors are open, locking means carried beneath the body of said car adapted to be actuated when said doors are opened to allow movement of the controlling means toward the neutral position but not away therefrom, and means adapted to open said circuit to release said locking means whereby the car may be moved at the will of the operator.

10. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a normally open circuit adapted to be closed when said doors are open, locking means carried beneath the body of said car adapted to be actuated when said doors are opened to allow movement of the controlling means toward the neutral position but not away therefrom, and a push button in said car for opening the circuit, whereby the locking means may be released to permit the movement of the car at the will of the operator.

11. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved from an operative to a neutral position, a circuit adapted to be closed when said doors are open, a rack associated with said controlling means, a solenoid, means

connected with the core of said solenoid adapted to engage said rack and allow movement of the controlling means toward the neutral position but not away therefrom, when said circuit is closed, and means for guiding the movement of said rack.

12. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved from an operative to a neutral position, a circuit adapted to be closed when said doors are open, a rack associated with said controlling means, a solenoid, means connected with the core of said solenoid adapted to engage said rack and allow movement of the controlling means toward the neutral position but not away therefrom when said circuit is closed, and means for guiding the movement of the core of said solenoid.

13. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a circuit adapted to be closed when said doors are open, a rack associated with said controlling means, a solenoid, means connected with the core of said solenoid adapted to engage said rack and allow movement of the controlling means toward the neutral position but not away therefrom when said circuit is closed, and means for guiding the movements of said rack and core and holding the same in operative relation.

14. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a circuit adapted to be opened and closed by the movement of said doors, a rack operatively associated with and movable by said controlling means, a solenoid secured beneath the floor of said car, a movable core for said solenoid, and means connected therewith adapted to engage said rack and allow movement of the controlling means toward the neutral position but not away therefrom when said core is moved into engagement therewith.

15. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a circuit adapted to be opened and closed by the movement of said doors, a rack operatively associated with and movable by said controlling means, a solenoid secured beneath the floor of said car, a movable core for said solenoid, and spring means for holding said core out of engagement with said rack.

16. In an apparatus of the character described, in combination, an elevator car, doors at the several floors, means controlling the operation of said elevator car adapted to be moved to either side of a neutral position, a circuit adapted to be opened and closed by the movement of said doors, a rack operatively associated with and movable by said controlling means, a solenoid secured beneath the floor of said car, a movable core for said solenoid, spring means for holding said core out of engagement with said rack, and means for adjusting the tension of said spring.

In testimony whereof I affix my signature, in the presence of two witnesses.

HENRY GEORGE HILLMAN.

Witnesses:
H. M. Seamans,
P. A. Blair.

R. P. LUMLEY & H. G. HILLMAN.

ELEVATOR DEVICE.

APPLICATION FILED MAY 25, 1907.

981,442. Patented Jan. 10, 1911.

Fig. 1.

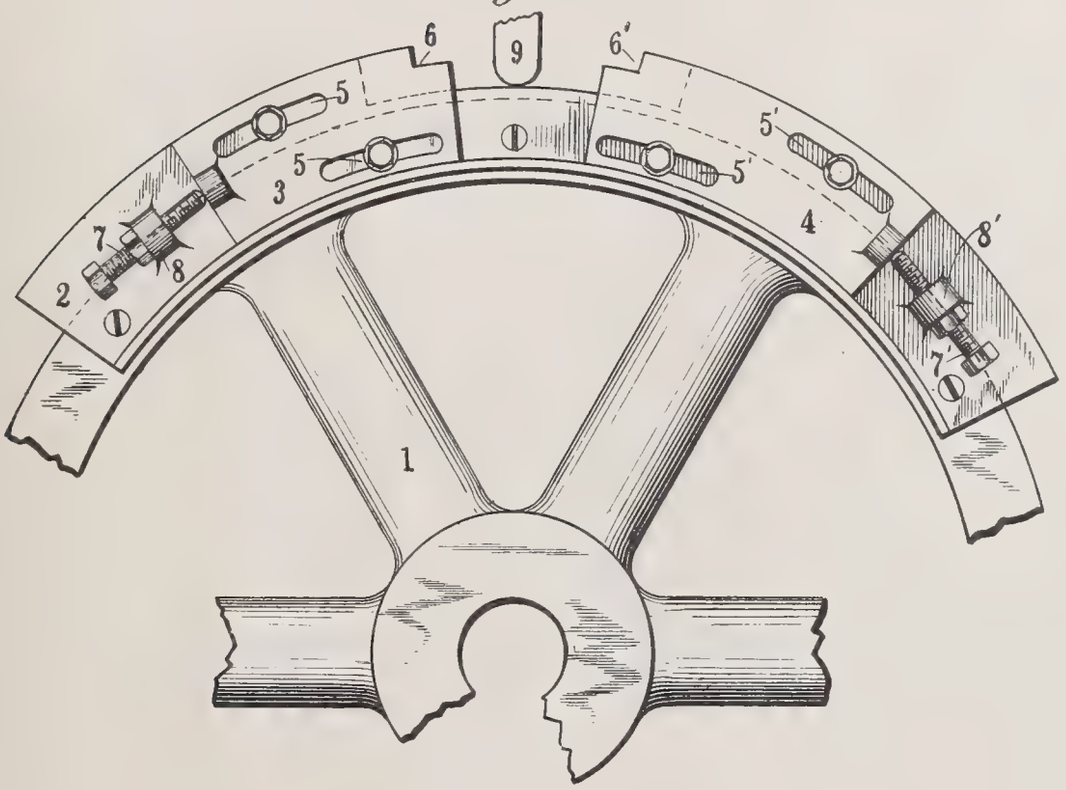
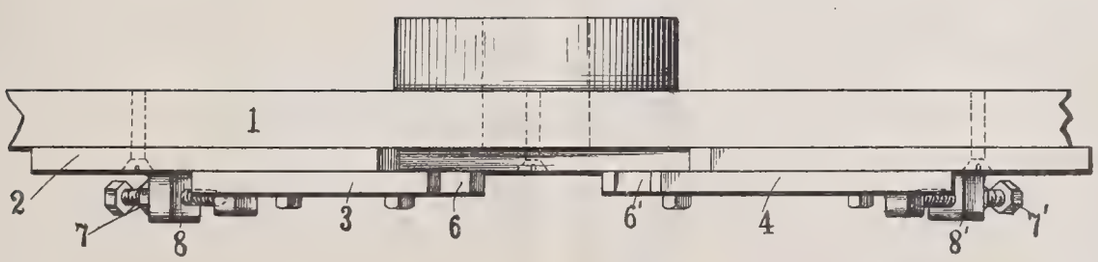


Fig. 2.



Robert P. Lumley,
Henry G. Hillman,
INVENTORS,

WITNESSES:
Leonard Liebl
William Whitstein

BY
Robt B. Killgore
ATTORNEY

THE NORRIS PETERS CO., WASHINGTON, D. C

UNITED STATES PATENT OFFICE.

ROBERT P. LUMLEY AND HENRY G. HILLMAN, OF NEW YORK, N. Y., ASSIGNORS TO PUBLIC SAFETY COMPANY, OF WASHINGTON, DISTRICT OF COLUMBIA, A CORPORATION OF DELAWARE.

ELEVATOR DEVICE.

981,442. Specification of Letters Patent. Patented Jan. 10, 1911.

Application filed May 25, 1907. Serial No. 375,756.

To all whom it may concern:

Be it known that we, ROBERT P. LUMLEY, a citizen of the United States, and HENRY G. HILLMAN, a subject of the King of Great Britain, both residing in the city, county, and State of New York, have invented a new and useful Improvement in Elevator Devices, of which the following is a specification.

This invention relates to elevator controlling mechanism and in regard to the more specific features thereof, to a safety device particularly adapted to be applied to the controlling mechanism whereby movement of the car is prevented after a door is opened.

One of the objects of the present invention is to provide a simple and practical device of the above nature which will be efficient in operation.

Another object is to provide a device of the above nature for use in connection with elevator safety systems that will be cheap to manufacture and may be installed on controlling apparatus of any form of elevator.

A further object of the present invention is to provide a device of the above nature that may be adjusted to compensate for variations and wear in the controlling mechanism in order that the neutral point may be engaged by the safety device when the controlling means is substantially in position to hold the car at rest.

The invention accordingly consists in the features of construction, combinations of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing wherein is shown one of various possible embodiments of our invention, Figure 1 is a partial front view of a controlling wheel with the safety device applied thereto. Fig. 2 is a top plan view of the same.

Similar reference numerals refer to similar parts throughout the several views.

Referring now to the drawing in detail, a rotatable controlling member 1 which in the embodiment shown is the valve wheel, has securely fixed thereto a plate 2 provided with a centrally disposed notch substantially as shown in Fig. 2. Adjustably mounted on this plate 2 are a plurality of plates 3 and 4 each of which is provided with slots 5, 5, and 5′, 5′, through which pass bolts to the plate 2 on the wheel 1. The inner corners of these plates are provided with notches or stepped down portions 6 and 6′ while the outer edges thereof are provided with projecting lugs adapted to be engaged by set screws 7 and 7′, passing through ears or lugs 8 and 8′ forming a part of the fixed plate 2. The ends of these set screws bear against the lugs on the slidable plates 3 and 4 and are provided at their opposite ends with nuts whereby they may be easily rotated and held in adjusted position by suitable lock nuts to move plates 3 and 4 relatively to the wheel in order that the neutral point may be shifted when found necessary by the wearing of the valves or other mechanism associated with the controlling of the elevator. For this purpose it is desirable to have the notch in the fixed plate 2 of a greater width than the notch or space between the plates 3 and 4.

A movable latch or finger 9, the end of which is shown in Fig. 1 adapted to be actuated on the opening or closing of any door on the various floors of the building in which the system is installed is adapted to engage the notch in the fixed plate 2 and the space between the adjustable plates 3 and 4 to prevent a movement of the controlling wheel away from the neutral position so long as the door is open. Should the door be opened while the car is in motion, as is frequently done when the car is about to stop at a floor, the finger 9 will be moved into engagement with the notches 6 or 6′ in the plates 3 or 4, thereby positively preventing a movement of the controlling wheel away from the neutral position to increase the speed of the car, yet allowing the wheel to be moved to the neutral position whereby the finger 9 will drop into the neutral point, thus positively holding the car against movement. The step down notches insure the engagement of the finger with the stop mechanism if the door is opened before the controller is thrown quite to neutral, but they permit less movement of the finger between the main stop plates after the finger slips down in the main slot by permitting of a narrower main slot for

a given latitude of controller movement. The space between the plates 3 and 4 is preferably wider than the finger 9 so that the controlling mechanism may be actuated to a slight extent, for instance, to compensate for leakage and to permit a slow movement of the car if desired, and also to more readily insure that the finger 9 will engage the neutral point and not pass over the same should the controlling mechanism be actuated at too great a speed.

The operation and the manner of use of this invention is substantially as follows: As the car approaches a floor at which it is desired to make a stop the controlling wheel 1 is rotated toward the neutral position to gradually slow down the car. Very likely the operator having the car under control will start to open the door before the car comes to a stand-still. As soon as the door is opened through suitable circuits not herein shown and described, the finger will be actuated to engage either the notch 6 or 6′ according to the direction in which the car is moving, thus positively preventing the operator from moving the controlling mechanism but slightly away from the neutral position. As soon as the car is stopped by the controlling wheel which will have then been rotated to the position shown in Fig. 1, the finger 9 will engage the neutral point thereof and positively hold the same against movement, except such as may be necessary to compensate for leakage, as above described, until the door is closed when the finger 9 will be drawn from the notch, allowing the controlling wheel to be rotated in either direction.

It may here be noted that the expression "neutral position" is used in this specification and claims to indicate the position assumed by the valve or other controlling mechanism, when the elevator is at rest and that with reference to the valve wheel, the "neutral point" is that point in the circumference thereof which will be opposite the latch or other locking means when the controlling mechanism is in "neutral position."

It is thus seen that this invention provides for a simple and practical device possessing the advantages and accomplishing, among others, the objects above set forth.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a device of the class described, in combination, a member adapted to be actuated by the opening and closing of a door, a rotatable controlling member, means associated with said controlling member having notches therein, adapted to be engaged by said first mentioned member when actuated by the opening of a door to permit movement of said controlling member toward the neutral position and lock the same against movement away therefrom, and means for adjusting said first mentioned means about said rotatable controlling member.

2. In a safety device adapted to be attached to an elevator controlling mechanism, in combination, a plate, and a pair of members mounted thereon having a space therebetween and oppositely disposed notches therein.

3. In a device of the class described, in combination, a member adapted to be actuated by the opening and closing of a door, a rotatable controlling member, plates secured to said member having an opening therebetween, and a notch at either side of the said opening adapted to be engaged by the said first mentioned member when actuated by the opening of a door to prevent a movement of said controlling member in either direction away from a neutral position and permit movement of said member toward a neutral position.

4. In a device of the class described, in combination, a member adapted to be actuated by the opening and closing of a door, a controlling member, an adjustable means having a central opening, a notch at either side of the said opening, adapted to be engaged by the said first mentioned member when actuated by the opening of a door to prevent a relative movement of said controlling member in either direction away from a neutral position and permit movement thereof toward a neutral position.

5. In a device of the class described, in combination, a member adapted to be actuated by the opening and closing of a door, a rotatable controlling member, an adjustable means having a central opening, a notch at either side of the said opening adapted to be engaged by the said first mentioned member when actuated by the opening of a door to prevent a movement of said controlling member in either direction away from a neutral position, and means adapted to engage said first mentioned means for adjusting same relatively to said controlling member.

6. In a device of the class described, in combination, a finger adapted to be actuated by the opening and closing of a door, a controlling member, a notched plate associated therewith adapted to be engaged by said finger when said controlling member is in its neutral position, and adjusting means engaging said notched plate for moving the same relatively to said controlling member and adapted to take up the end thrust on said notched plate when engaged by said finger, whereby said plate is prevented from being moved out of adjusted position.

7. In a device of the class described, in combination, a finger adapted to be actuated by the opening and closing of a door, a rotatable controlling wheel, a plurality of plates secured to said controlling wheel having a space therebetween at the neutral point adapted to receive said finger when the door is open to hold said wheel against rotation and means associated with said plates permitting a relative movement of said controlling member toward a neutral position and locking the same against movement away therefrom.

8. In a device of the class described, in combination, a finger adapted to be actuated by the opening and closing of a door, a controlling member, a plurality of plates secured to said controlling member having a space therebetween at the neutral point adapted to receive said finger when the door is open to hold said member against relative movement, and means for adjusting one of said plates to shift the neutral point, said plates having means associated therewith whereby the controlling member may be moved toward the neutral position and locked against movement away therefrom.

9. In a device of the class described, in combination, a finger adapted to be actuated by the opening and closing of a door, a controlling means, a plurality of plates secured to said controlling means having a space therebetween at the neutral point adapted to receive said finger when the door is open to hold said means against movement, and means for adjusting both of said plates to shift the neutral point, said plates having means associated therewith whereby the controlling member may be moved toward the neutral position and locked against movement away therefrom.

10. In a device of the class described, in combination, a finger adapted to be actuated by the opening and closing of a door, a rotatable controlling wheel, a plurality of plates secured to said controlling wheel having a space therebetween at the neutral point adapted to receive said finger when the door is open to hold said wheel against rotation, and means engaging both of said plates whereby the same may be adjusted relatively to said controlling wheel for altering the position of said neutral point, said plates having means associated therewith whereby the controlling wheel may be moved toward a neutral position and locked against movement away therefrom.

11. In a device of the class described, in combination, a finger adapted to be actuated by the opening and closing of a door, a rotatable controlling wheel, a plurality of plates secured to said controlling wheel having a space therebetween at the neutral point adapted to receive said finger when the door is open to hold said wheel against rotation, lugs on said plates and set screws engaging said lugs for moving said plates relatively to said controlling wheel whereby the neutral point is shifted, said plates having means associated therewith whereby the controlling wheel may be moved toward a neutral position and locked against movement away therefrom.

12. In a device of the class described, in combination, a finger adapted to be actuated by the opening and closing of a door, a rotatable controlling wheel, a plurality of plates secured to said controlling wheel having a space therebetween at the neutral point adapted to receive said finger when the door is open to hold said wheel against rotation, lugs on said plates, and set screws engaging said lugs for moving said plates relatively to said controlling wheel whereby the neutral point is shifted, one of said plates having a notch adapted to be engaged by said finger before the wheel is rotated to neutral position whereby rotation away from neutral position is prevented after one of the doors is opened.

13. In a device of the class described, in combination, a finger adapted to be actuated by the opening and closing of a door, a rotatable controlling wheel, a plate on said wheel, a plurality of plates secured to said first mentioned plate having a space therebetween adapted to be engaged by said finger when a door is open, and set-screws secured to said first mentioned plate for adjusting the position of said second mentioned plates.

14. In a device of the class described, in combination, a finger adapted to be actuated by the opening and closing of a door, a rotatable controlling wheel, a plate on said wheel, a plurality of plates secured to said first mentioned plate having a space therebetween adapted to be engaged by said finger when a door is open, said second mentioned plates having notches adapted to be engaged by said finger to prevent a movement of the controlling wheel away from neutral position.

15. Adjustable notch mechanism comprising a notched plate adapted to be secured to the rim of a wheel; a pair of slidable pieces on said notched plate in position to narrow the notch therein; means for hold-

ing the slidable pieces to the fixed piece; and means for adjusting the positions of the slidable pieces with respect to one another, in combination with a suitably controlled locking finger or bolt adapted to be projected into and out of the notch between such slidable pieces.

16. Adjustable notch mechanism comprising a notched plate adapted to be secured to the rim of a wheel; a pair of slidable pieces on said fixed plate in position to narrow the notch therein and being provided with stepped inner corners; means for holding the slidable pieces to the fixed plate; and means for adjusting the positions of the slidable pieces with respect to one another.

17. Adjustable slot mechanism comprising a notched plate adapted to be secured to the rim of a wheel; a pair of slidable pieces each provided with slots; bolts extending through said slots and engaging the notched plate for the purpose of holding the slidable pieces on the notched plate; and adjusting screws carried on said notched plate and bearing on said slidable pieces whereby the relative positions of the slidable pieces may be varied, in combination with a suitably controlled locking finger or bolt adapted to be projected into and out of said notch.

18. Adjustable slot mechanism comprising a notched plate adapted to be secured to the rim of a wheel; a pair of slidable pieces each provided with slots and stepped inner corners; bolts extending through said slots and engaging the notched plate for the purpose of securing the slidable pieces to the notched plate; adjusting screws carried on said notched plate and bearing on said slidable pieces whereby the relative positions of the slidable pieces may be varied; and lock nuts on said adjusting screws.

In testimony whereof we have signed our names hereto in the presence of two attesting witnesses.

ROBERT P. LUMLEY.
HENRY G. HILLMAN.

Witnesses:
Robt. B. Killgore,
Conrad Dieihl.

A. NÉMETH.

ELEVATOR SAFETY DEVICE.

APPLICATION FILED NOV. 10, 1910.

983,079. Patented Jan. 31, 1911.

Fig. 1.

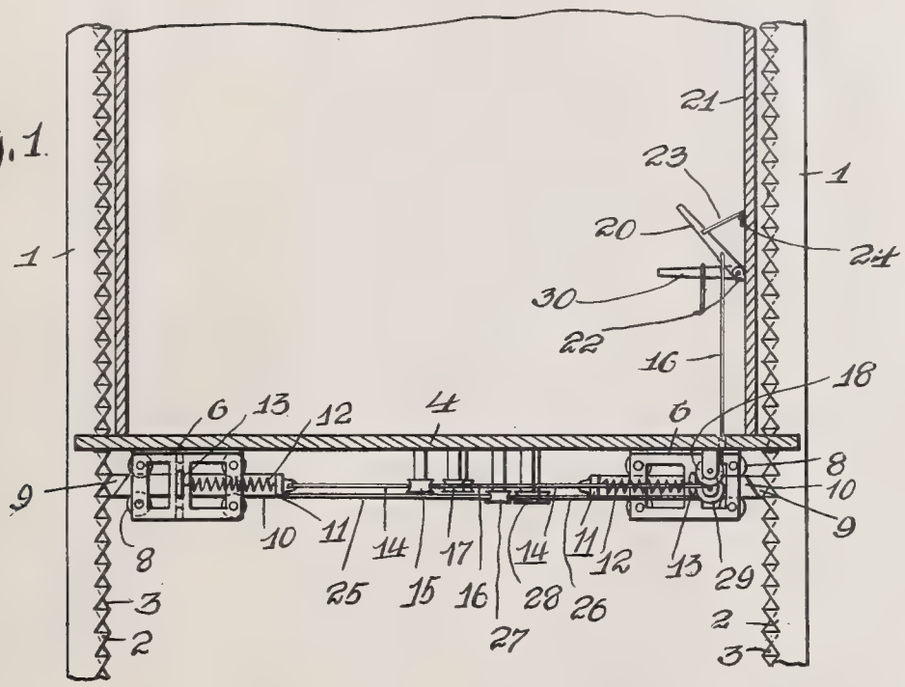
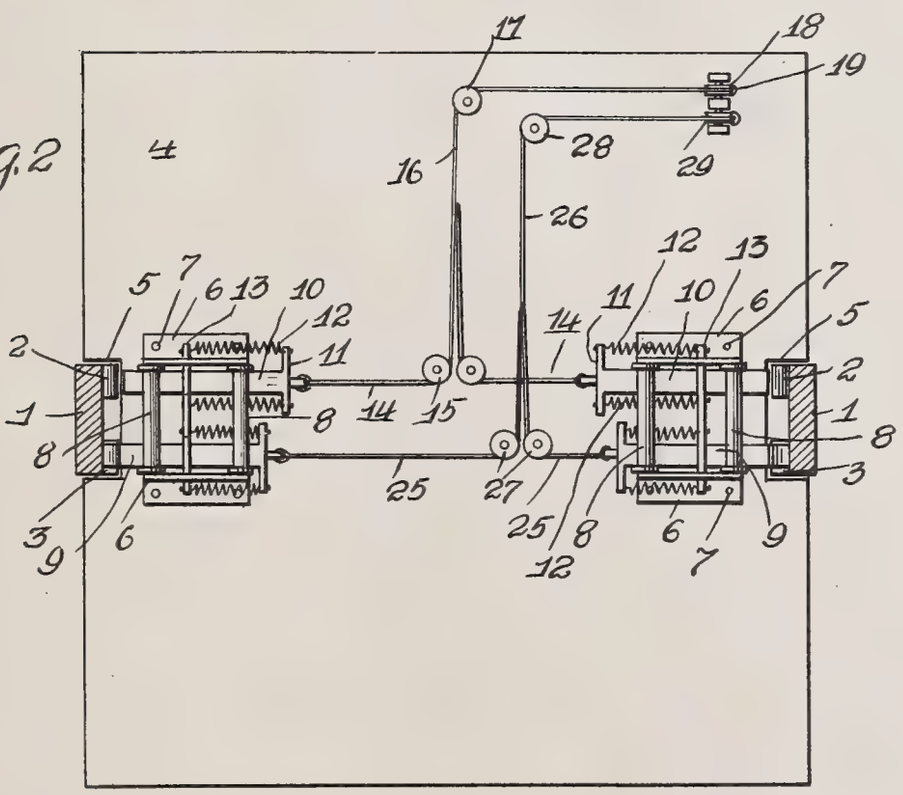


Fig. 2.



WITNESSES

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UNITED STATES PATENT OFFICE.

ALEXANDER NÉMETH, OF SOUTH BEND, INDIANA.

ELEVATOR SAFETY DEVICE.

983,079. Specification of Letters Patent. Patented Jan. 31, 1911.

Application filed November 10, 1910. Serial No. 591,703.

To all whom it may concern:

Be it known that I, ALEXANDER NÉMETH, a subject of the King of Hungary, residing at South Bend, in the county of St. Joseph and State of Indiana, have invented certain new and useful Improvements in Elevator Safety Devices, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to an elevator safety device, and the invention has for its primary object to provide means in a manner as will be hereinafter set forth for preventing an accidental and rapid descent or ascent of an elevator cage or platform.

Another object of this invention is to provide a safety device that can be advantageously used for stopping an elevator cage when the hoisting cables thereof break or when the engine employed for operating the cage runs away, these accidents often resulting in the loss of life and the destruction of property, and I aim to obviate such accidents by a locking mechanism that can be easily and quickly actuated to stop and release an elevator cage.

A still further object of the invention is to accomplish the above results by a mechanism that is simple and durable, applicable to various types of elevator cages, and efficient as a safety device.

With the above and such other objects in view as may hereinafter appear the invention consists of the novel construction, combination, and arrangement of parts to be hereinafter specifically described and then claimed.

Reference will now be had to the drawing, wherein:

Figure 1 is a vertical sectional view of an elevator cage provided with the safety device, and Fig. 2 is a bottom plan of the same.

1 denotes the side and guide rails of an elevator shaft, these rails having the confronting faces thereof provided with two racks 2 and 3, the teeth of the rack 2 being arranged the reverse of the teeth of the rack 3, the rack 2 preventing a sudden descent of the elevator cage and the rack 3 a sudden ascent thereof, as will hereinafter appear.

4 denotes the bottom or floor of an elevator cage, which is cut-away, as at 5, to provide clearance for the side and guide rails 1. The floor 4 is provided with sets of depending bearings 6, said bearings being riveted or otherwise secured to the floor 4, as at 7, with the sets 6 confronting the rails 1. Revolubly mounted in each set of bearings are guide rollers 8 supporting gripping bars 9 and 10, the gripping bars 10 being used in connection with the racks 2 and the gripping bars 9 in connection with the racks 3. The bars 9 and 10 have the outer ends provided with teeth to engage the teeth of the racks 3 and 2 and the inner ends with cross heads 11, said cross heads being connected by retractile springs 12 to a cross bar 13 arranged in each set of bearings, said cross bar being cut-away or provided with openings to clear the gripping bars 9 and 10.

The cross heads 11 of the gripping bars 10 are connected to branch cables 14 passing over revoluble sheaves 15 carried by the floor 4 of the elevator cage, said branch cables being connected to a main cable 16 that passes around a revoluble sheave 17 under another sheave 18 and upwardly through a hole 19 provided therefor in the floor 4 of the cage. The sheaves 17 and 18 are supported by the bottom of the floor 4, and the end of the cable 16 is attached to a lever 20 pivotally connected to the side wall 21 of the cage, as at 22, said lever being held in an elevated position by a hook 23 engaging in a staple 24, carried by the side of the cage.

The cross heads 11 and the gripping bars 9 are connected by branch cables 25 to a main cable 26, said branch cables passing over sheaves 27 and the main cable 26 over sheaves 28 and 29, all of said sheaves being supported from the bottom of the cage floor 4. The cable 26 is connected to a pivoted lever 30 similar to the lever 20, the lever 30 being shown in a released position and the lever 20 in a locked position.

With the levers in a locked position the retractile springs 12 are retained under tension, whereby when the levers are released, the gripping bars 9 and 10 will be immediately shifted into engagement with their respective racks, thereby preventing a sudden descent or ascent of the elevator cage.

It is thought that the operation and utility of the safety device will be apparent without further description, and while in the drawings there is illustrated a preferred embodiment of the invention, it is to be un-

derstood that the structural elements thereof are susceptible to such changes as fall within the scope of the appended claim.

What I claim, is:

In an elevator safety device, the combination with oppositely disposed guide rails, each guide rail having two racks with the teeth of one rack the reverse of the teeth of the other rack, and a cage adapted to slide between said rails, of depending bearings carried by said cage, anti-friction guide rollers journaled in said bearings, gripping bars movably mounted between said guide rollers and adapted to engage said racks, sheaves carried by the bottom of said cage, cables connected to the inner ends of said bars and passing over said sheaves and upwardly through the bottom of said cage, levers pivotally connected to the inner side of said cage and to the ends of said cables, means including retractile springs adapted to shift said gripping bars into engagement with said racks, and means including hooks adapted to normally hold said levers in an elevated position with said springs under tension, substantially as and for the purpose herein described.

In testimony whereof I affix my signature in the presence of two witnesses.

ALEX. NÉMETH.

Witnesses:
ALEX. X. SÓCRIH,
CHAS. G. ABRAHAM.

J. B. McKEOWN.

ELEVATOR LOCK.

APPLICATION FILED SEPT. 10, 1909.

990,281. Patented Apr. 25, 1911.

Fig. 1.

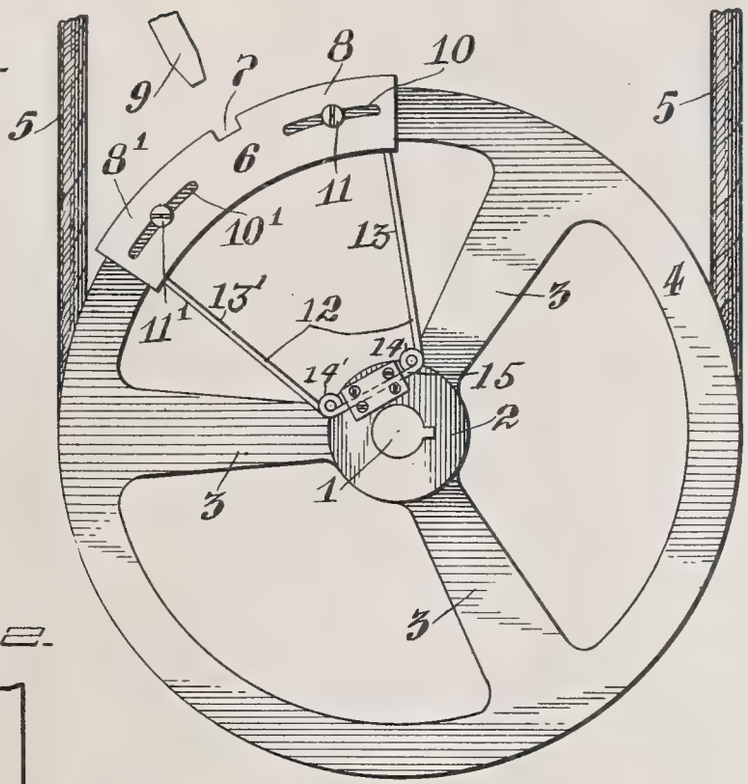


Fig. 2.

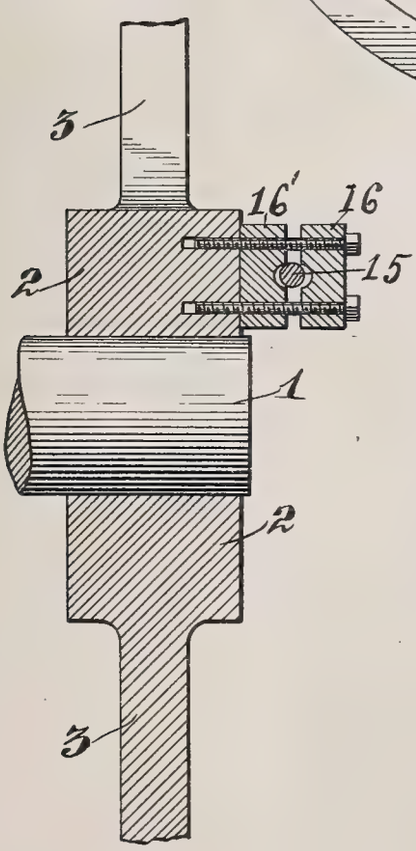
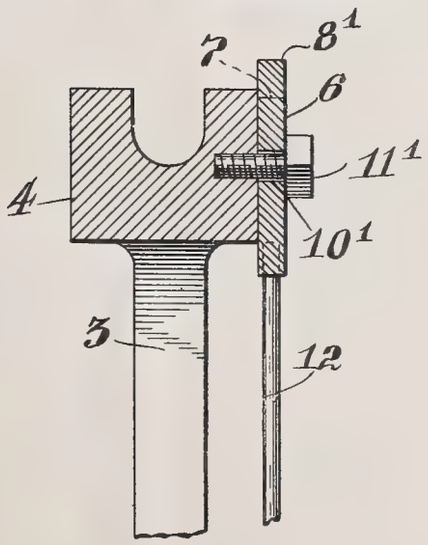


Fig. 3.



Attest:

C. O. Mitchell

C. S. Ashley

Joseph B. McKeown,
Inventor:

by Robt B. Killgore
Atty

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOSEPH B. McKEOWN, OF UNION HILL, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PUBLIC SAFETY COMPANY, A CORPORATION OF DELAWARE.

ELEVATOR-LOCK.

990,281. Specification of Letters Patent. **Patented Apr. 25, 1911.**

Application filed September 10, 1909. Serial No. 517,049.

To all whom it may concern:

Be it known that I, JOSEPH B. McKEOWN, a citizen of the United States, residing at Union Hill, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Elevator-Locks, of which the following is a specification.

My invention relates to improvements in locks to be applied to the valve controlling mechanism of elevators in connection with interlocking systems designed to prevent motion of the car while a gate is open.

My objects are the simple and cheap construction of such devices, the absolute locking of the car against motion but, at the same time, affording means whereby the valve may be moved slightly to compensate for leakages which would otherwise cause the car to rise or fall and to provide means for returning the valve to cut-off position after compensation.

In the accompanying drawing Figure 1 is a view of a form of my device on a valve wheel; Fig. 2 a view of the spring fastening; and Fig. 3 a view, partly in section, of the notched locking plate on the valve wheel.

1 is the valve wheel shaft, 2 the valve wheel hub, 3 the spokes of the valve wheel, 4 the grooved rim of the valve wheel and 5 the controller rope running to the lever or other controlling mechanism on the car in the shaft.

My device comprises a plate 6 having a notch 7 in the outer edge and a bearing surface 8, 8′ extending on either side thereof. These bearing surfaces are long enough to accommodate all the travel of the wheel with respect to a bolt 9 moved by any suitable means, whether mechanical or electrical, into and out of the path of travel of the plate 6, its movement being controlled by the opening or closing of a gate. This plate 6 is secured to the wheel by means of studs 11, 11′ working in the slots 10, 10′ so that the plate is free to move slightly on the wheel, the limit of motion being the length of the slots. To maintain this plate at its normal position so that the notch will aline with the bolt when the wheel is at the cut off position a spring 12 is provided. As shown this spring has the arms 13, 13′ secured to the plate, coils 14, 14′ and short connection 15. The two blocks 16, 16′ each grooved on its inner face are bolted together and to the wheel hub with the part 15 of the spring in the groove. This forms an elastic mounting for the notched plate the uses of which will be more fully set forth.

In operation the opening of the gate causes the bolt 9 to fall against the edge of the plate 6 and on turning the wheel to close the valve and stop the car the bolt will fall into the notch 7, for which it is a snug fit, and lock the valve at cut off position. As there is no play between the notch and bolt the car is firmly locked while the gate is opened. If either piston or valve is leaking the wheel may be moved in either direction against the compression of the spring 12 until the limit of motion, as determined by the slots 10, 10′, is reached thereby permitting enough water to leak in or out to hold the car at the floor. When the car is started the gate is closed which retracts the bolt and permits the wheel to be turned to run the car at full speed.

It is apparent that the valve can only be turned when the bolt is in the notch by the application of enough power to overcome the resistance of the spring and that upon this force being withdrawn the valve will be automatically moved back to cut off position. This feature of compensation with positive locking and automatic return to cutoff position distinguishes my invention from other locks wherein compensation may be provided but no provision is made for positive locking or for automatically returning the valve to cut off position if it is slightly moved.

I claim:—

1. An elevator lock comprising a bolt movable by the opening and closing of a gate; a notched plate, coacting with the bolt, secured to the controlling means for the valve the controller being capable of a limited movement with respect to the plate while the bolt is engaged in the notch and yielding means for normally returning the controller to cut off position while the bolt and notch are engaged.

2. An elevator lock comprising a bolt movable by the opening and closing of a gate; a valve wheel, a notched, slotted plate co-acting with the bolt; studs extending through the slots and securing the plate to the valve wheel; whereby the wheel may be

turned to a limited extent while plate and bolt are engaged; and a spring secured to the wheel and to the plate for maintaining the plate in normal position but capable of compression upon the application of power to the wheel while plate and bolt are engaged.

In testimony whereof I have affixed my signature in presence of two witnesses.

JOSEPH B. McKEOWN.

Witnesses:
ROBT. B. KILLGORE,
F. MCINERNEY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

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